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SERVING THE RURAL CUSTOMER.

Those who have made a close study of utility matters unhesitatingly predict that the time is coming when nearly every central-station company will have to squarely face the problem of line extensions to serve the rural customer. Already, in some sections of the country, the supply companies are being besieged by farmers with requests for service, and this demand is rapidly growing in proportion. Certainly those companies which, in their wisdom, adopt a clearly defined policy in connection with this business, will find their efforts well repaid.

One of the most striking features in connection with rural business obtained is the great variation in the practices and policies of the utilities supplying this business. This is brought out very clearly in a report submitted before the recent convention of the Iowa Section, National Electric Light Association, by Mr. W. H. Burtis, who summarized replies received from 34 companies maintaining farmer lines.

Practically all central stations are agreed that lines should be extended to serve farmers when the business conditions warrant it, but the question of whether the farmers should pay for the cost of building the line or whether this expense should be assumed by the company, seems to be the first stumbling block. A majority of the companies involved in the report previously referred to, strongly favored requiring the farmers to pay for the cost of extensions necessary to serve them. The farmer of today fully appreciates the advantages of electric service and is willing and able to pay his share of the cost of obtaining service. Excellent results have been obtained where groups of farmers have been encouraged to incorporate, and to arrange for service at wholesale rates, appointing a representative to read meters, make collections, etc. This practice seems to be the logical solution of the problem of serving the rural customer.

Other points which should be given serious consideration in connection with rural business are the matter of rates for service, core losses, and adequate protection of the line. The Iowa central stations agree that the same rates should be charged as for city service, except that a higher monthly minimum charge should be made.

Unless these items are given serious consideration, there is a possibility that the rural business will be found unprofitable, because of the excessive investment required. However, a very encouraging feature in connection with the possibility of securing a large

amount of farmer patronage at a profit, should be found in the fact that many farmers are paying from $300 to $700 for individual lighting systems of one kind or another, and this investment represents much more than would be required were these farmers to form communities and arrange for service from the utility company. While central stations should have a thorough understanding of all features in connection with this business before making extensions, there is danger that if this is delayed too long they will be confronted with the same competition as is now encountered in urban communities, as isolated lighting plants and gasoline engines for farm service are increasing at a rapid rate.

ENGINEERS AND CONSTITUTIONAL REVISION.

A committee made up of engineers representing five national engineering societies and also two local engineering societies in New York City have drawn up a set of suggestions for submission to the New York State constitutional convention. The report points out the importance of engineering work in present-day governmental activities and emphasizes the fact that such work should be carried out under the direction and with the counsel of competent engineers. As principles to be observed in formulating a state constitution they propose a short ballot, sufficient tenure of office to attract competent men and make possible their efficiency, a continuing policy in organization of departments, the selection of heads of departments by appointment rather than election, the opportunity for the development of natural resources and a recognition of the value of engineering experts in the membership of certain departments and courts.

Among the different recommendations made are the abolition of the office of state engineer and the transfer of his duties to a department of engineering and public works composed of three commissioners with twelve-year terms, of whom at least one should be a professional engineer; a department of public utilities with five commissioners having ten-year terms, of whom at least two shall be professional engineers; that any building department should include at least one engineer; that any board of claims should have one-third of its membership made up of engineers; that removal of commissioners should be only for cause; that legislation should be permitted for the reference by a court of technical matters to a technical referee; and that the present constitutional prohibition against the use and sale of land and cutting of trees within forest preserves should be removed.

It is an excellent sign when engineers thus display some initiative in the direction of having placed in the organic law of a state a proper recognition of the necessity for expert engineering service in carrying on those activities of government which are primarily of an engineering nature. Such activities already make up a large part of the duties of a municipal administration and are ever becoming of increasing importance in state matters. Attention has repeatedly been called to the importance of engineering knowledge in members of public service commissions and the infrequency in the appointment of engineers to membership upon such commissions. It is only by engineers taking an active interest in these matters and putting their views of the requirements before legislators and before the members of such a constitutional convention that proper recognition will be given to these facts. As stated by President Lidbury in his presidential address before the American Electrochemical Society last week, legislators are only too glad to have correct information provided for them in technical matters, and it is the duty as well as the privilege of engineers to see that engineering questions are properly presented before legislative bodies.

Aside from the merit of the particular recommendations made in the New York case the fact that engineers have made a move in the matter is a healthy sign.

A NATIONAL ELECTRICAL SAFETY CODE.

In 1897 the first edition of the National Electrical Code was brought out by the National Board of Fire Underwriters, after collaboration with central stations and electrical engineers, in order to unify the requirements of the insurance interests in providing for safe electrical construction. This Code has been revised at two-year intervals and greatly expanded, and although certain requirements have been introduced which have a bearing upon casualties and hazards to life, the fundamental consideration in formulating these rules has been the elimination of fire hazards in the construction and installation of electrical equipment.

The National Electrical Code has been enforced as far as possible by insurance inspectors all over the country and is moreover the basis of the rulings of a large number of municipal inspectors. Even where municipalities have adopted an individual code, it is generally based upon the National Code and differs in containing more stringent requirements than are generally found advisable.

Attention to safeguarding life has been much less general, but has been taken up during recent years by the Bureau of Standards. Last year this Bureau published a compilation of operating rules, which was intended to form a portion of a National Electrical Safety Code. The remaining three portions have now been issued in preliminary form and after revision the complete Code will be published. The revision will take place during the present year with the assistance of representatives of public service commissions, municipal inspectors, engineering societies, electrical workers, insurance companies, manufacturers and others interested in the subject.

The need of such a Code was shown last year when the Wisconsin Industrial Commission took steps to formulate one. A uniform code, national in its application, is much to be preferred to a variety of local codes, and the work of the Bureau of Standards is valuable for that reason, and for the wider circle

of co-operation obtained in its formulation. It will no doubt receive more extended criticism than would be given to any local code, and its periodical revision will also be undertaken with the benefit of field experience obtained over a wide territory. Circular No. 49, issued last year, has already been revised in conjunction with the Accident Committee of the National Electric Light Association.

The enforcement of such a Code will probably come about through its legal adoption by states or municipalities, but even where not made mandatory it should supply a recognized standard which would be generally adhered to.

Criticism of the proposed rules is invited, and those interested should secure a copy of Circular No. 54 from Director S. W. Stratton at Washington.

FINANCING ENGINEERING SOCIETIES.

Most engineering societies, like the typical city, grow up in a haphazard way, and without a very definite plan. Their originators cannot foresee future growth and developments, nor the lines along which their greatest activities will be exerted. The possibilities for valuable work are many, and upon the ideas of the particular individuals chosen for the executive positions depend the form of effort undertaken and the nature of the results achieved. The first requisite to accomplishment is the co-operation of a sufficient number of those engaged or interested in the given line of work. This support is necessary not only for its moral or psychological significance but for financial reasons. It measures usually the income of the society, and therefore its expenditures. For while it may be considered wise policy to accumulate a slight surplus, expenditures will otherwise grow as fast as income, since it is an executive of meager resourcefulness who does not find profitable avenues of expenditure for all available resources. The field for such effort is unlimited. Normally this field can be occupied only to the extent made possible by regular income. And it is here that many societies, following the example of our Federal Government, go astray. Instead of planning their activities in accordance with a budget which has been worked out in a business-like way to fit the existing income, they plunge into the activities which appeal most strongly to the directorate, and afterwards look around for the wherewithal to pay the bills. It must be evident that no specified amount of revenue will ever be permanently adequate for a society run after this fashion.

The Illuminating Engineering Society furnishes an example in point. Finding more avenues of usefulness than its treasury could support (as any competent executive can always do), an attempt to increase the income was made two years ago by creating a class of sustaining members. While this is open to individuals as well as companies, it is not attractive to the former since it involves disqualification from voting and holding office. Now the directors come forward with an indictment of their own competence to the effect that they are spending annually about $8 per member, whereas the dues are but $5, and ask for a constitutional change which will permit the conscientious to pay $10 into the treasury by segregating themselves into a more exclusive class of membership with very indefinite qualifications—qualifications so loose in fact as to be open to all. Instead of abolishing the absurd disqualification of sustaining members above mentioned, it is now proposed to disqualify from holding office all who do not acquiesce in the payment of increased dues, a purely plutocratic distinction. Just why members paying $25 or $5 should be disqualified, while the great opportunity of serving the cause as a director of the Society is reserved to those paying exactly $10 per annum, has not been explained.

The experiment of the American Institute of Electrical Engineers in creating a new grade of membership in 1912 should not be lost on the Illuminating Engineering Society. This 50-per-cent failure resulted in disqualifying from the highest offices over nine-tenths of the membership, and from all participation in the management of the society 80 per cent of the present membership. We refer to this change as a 50-per-cent failure, because of the estimated changes in classes of membership, less than 50 per cent had transpired at the end of the first year and in consequence less than five per cent increase in revenue was realized.

If the Illuminating Engineering Society is looking for a model it might well take notice of the American Electrochemical Society, which conducts its affairs on a democratic basis with efficient management, and the same dues as the former society. It holds two conventions each year, and publishes two volumes of transactions. With the rapidly increasing number of societies which the engineer has to support, a proposal to increase dues cannot be expected to be popular nor to have any other effect than to keep a large proportion of members in the associate class. If attainments in the profession are to be recognized by a different class of membership, this can easily be accomplished, as in the American Association for the Advancement of Science, without any distinction in dues. To create a distinction based primarily upon payment of dues, and which will be utilized mainly for business advantage, is out of place in engineering societies.

The financial measures and membership qualifications and privileges are not, however, the only proposed amendments to the constitution of the Illuminating Engineering Society to which question might be raised. The proposed change to Article XII does away with the requirement of a two-thirds vote to pass an amendment, without substituting any other provision, and leaves the time indefinite when amendments shall take effect. Article VIII, section 1, restricts the annual meeting to New York State. Why Buffalo should be given such preference over Jersey City or Philadelphia is not clear. And why would it not be preferable to hold the annual business meeting in conjunction with the annual convention?

Iowa Railway Association Elects Officers.

A two-day convention of the Iowa Street and Interurban Railway Association was held at Keokuk, Ia., April 22 and 23 in conjunction with the annual convention of the Iowa Section, N. E. L. A.

The election of officers resulted as follows:

President, R. A. Leussler, Omaha.

Vice-president, J. F. Porter, Davenport.

Secretary-treasurer, H. E. Weeks, Davenport.

C. E. Fahrney was elected a member of the Executive Committee, succeeding C. D. Cass, of Waterloo, whose term expired.

Papers were presented during the convention on "Arrangement of Evening Schedules," by L. L. Sloss; "Measures for Welfare of Employees," by M. A. Welsh; "Safety First," by F. K. George; "Investigation and Care of Railway Circuits," by F. V. Skelley, and "The Jitney Bus," by C. I. Palm.

Presentation of Edison Medal to Alexander Graham Bell.

The sixth Edison Medal, which on December 29, 1914, was awarded to Alexander Graham Bell "For Meritorious Achievement in the Invention of the Telephone" will be presented to Dr. Bell at the annual meeting of the American Institute of Electrical Engineers at the Engineering Societies Building, New York City, on Tuesday evening, May 18, 1915.

Thomas A. Watson, of Boston, Mass., who was associated with Dr. Bell in the early days of the telephone, will give a historical review of the evolution and development of the art of telephony.

Wisconsin Summer School.

The fifteenth annual summer session of the College of Engineering of the University of Wisconsin will be held at Madison during the six weeks' period beginning June 21.

Special courses will be given in electrical, steam, and hydraulic engineering, gas engines, machine design, mechanical drawing, mechanics, shopwork and surveying. All courses given in the University summer session are open to engineering students.

Special courses have been arranged for manual arts and vocational teachers.

For information address F. E. Turneaure, dean, Madison, Wis.

Wireless Across the Pacific.

On February 2 the Pacific Ocean was bridged by wireless messages between the Marconi station at Honolulu and the Japanese station at Ochiishi. The distance between these two stations is over 3,400 miles.

Electricity in the Navy.

A very interesting and instructive address, with stereopticon views, was given by Lieut. W. K. Kilpatrick, of the United States Navy and attached to the Charlestown (Mass.) Navy Yard, before the Boston Edison Section, N. E. L. A., April 20, at the Engineers' Club, Boston, Mass.

President L. R. Wallis, of the Section, was chairman of the meeting, and introduced the speaker, whose subject was "Electricity in the Navy."

The speaker outlined the substitution of electric drive for steam in modern vessels of war, and said the submarine would be hardly a practicable type of vessel except for the introduction of the storage battery and the electric motor. Every process aboard these craft is electrical.

Views were shown of the exteriors and the interior arrangements of submarines K-1, E-1 and E-2, the latter series the first to be equipped with the Sperry gyrocompass. Rudder operation is through push-button switches. The craft are each divided into four compartments. A periscope turning motor is one of the latest devices. This is of 0.25 horsepower and is geared to the instrument.

The central compartment contains electric ranges and a depth-index gauge. The forward compartment contains the torpedo truck and motor-driven capstan.

Minneapolis Jovian Meeting.

One of the most interesting talks heard at the meetings of the Minneapolis Jovian League this year was given April 20 by Superintendent Frank McDonald of the Minneapolis workhouse.

Owing to the approach of summer weather, the last spring meeting of the league at which there will be a program will be held May 3, when an entertainment of new and original stunts will be given. After that date the league will continue to have its informal bi-weekly luncheons as usual until fall, when another popular educative program will be started.

Salina Jovians Organize.

A Jovian chapter with an initial membership of fourteen was established in Salina, Kans., recently. The drill team of the Wichita Jovian chapter initiated the candidates. There were 20 Jovians from Wichita in Salina for the meeting. There are nearly 100 persons in Salina and adjacent territory who are eligible to membership in the Salina chapter and it has a bright outlook. L. O. Ripley, state Jovian organizer, presided at the meeting. After the meeting the Jovians repaired to the Planters Hotel for supper.

Big Electrical-Prosperity-Week Meetings Held.

Jovian Clubs, Chambers of Commerce and Rotary Clubs have taken up "Electrical Prosperity Week" with a vim. Four rousing meetings were held in Ohio last week and enthusiastic promises of support were voted. The respective organizations in Cleveland, Cincinnati and Toledo were addressed by leading members of the staff of the Society for Electrical Development, who told of some of the plans for the big sales campaign now under way. Two meetings were held in Cleveland. The first was held under the auspices of the Electrical League of Cleveland at the Hollenden Hotel on April 21. Over 275 prominent electrical men from northern Ohio cities were present. A big Jovian luncheon crowd on April 22 heard H. W. Alexander talk on "Sales Making" and G. B. Muldaur on the work of his section in harmonizing relations between electrical interests. J. M. Wakeman also spoke.

A big gathering of representative men at the Hotel Secor, Toledo, on April 23, heard Messrs. Wakeman, Alexander and Edgell discuss plans for the "Electrical Prosperity Week" movement. This was under the auspices of the Rotary Club.

Plans were made for a combined meeting of the Jovians, the members of the Rotary Club and the Toledo Chamber of Commerce on May 6.

Mr. Edgell spoke before the Cincinnati Association of Display Men at the Chamber of Commerce on April 22.

Hearty support of the Jovian order in the big Electrical Prosperity Week campaign is promised. At the recent meeting of the Jovian Congress and Past Jupiters Association in Chicago, a resolution was passed to accept an invitation to participate and request its various local organizations to cooperate in the movement.

General Manager J. M. Wakeman of the Society for Electrical Development sent the invitation to Jupiter Homer E. Niesz, who replied that any assistance that can be rendered by the present administration will be very gladly given.

Convention Dates Announced.

The annual convention of the Association of Iron and Steel Electrical Engineers will be held at the Hotel Statler, Detroit, Mich., September 8 to 11. W. T. Snyder, McKeesport, Pa., is secretary of the association.

The International Association of Municipal Electricians wil hold its annual convention at Cincinnati, O., August 24 to 27. Headquarters will be at the Gibson Hotel. Clarence R. George, Houston, Tex., is secretary.

Electricity in Hardware Manufacturing.

This article discusses the advantages of electric motor drive for hardware - manufacturing plants and comments on some of the more important problems of motor application. Detailed data are given on the economy of central-station service in one plant as compared with a gas-producer plant previously used.

Individual motors for the greater proportion of machine tools, and small group drive, have done much to better the conditions in hardware manufacturing plants, increasing the output and at the same time reducing the maintenance cost, eliminating not only the dangers attendant on the many rapidly moving belts and pulleys, but the enormous friction losses in the many bearings and slipping belts.

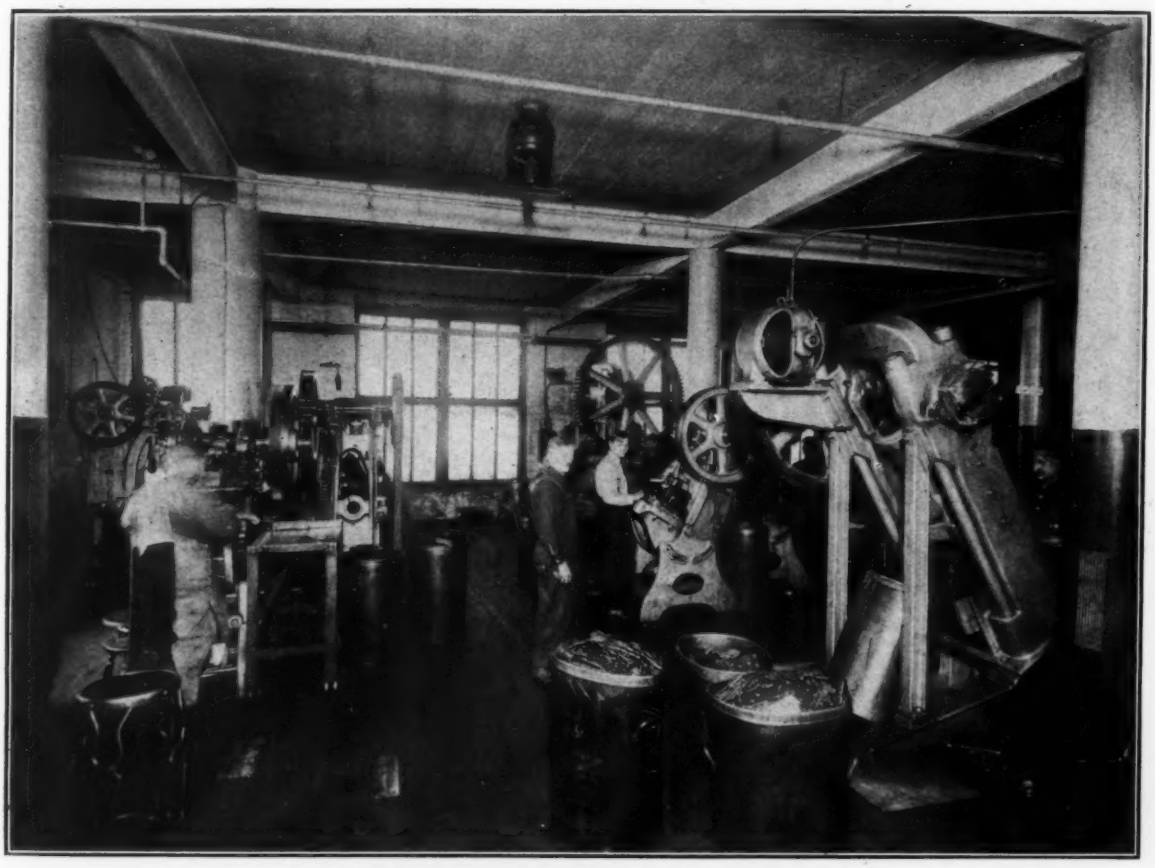
It is said that the friction losses in ordinary belt-driven shop equipment averages about 75 watts per horsepower for each hanger, and while this may seem to be excessive it is not at all improbable, taking into consideration the fact that hangers must be placed at frequent intervals on a line shaft and in many buildings become much displaced in alinement owing to the settling of floors from varying load strains placed on them and the side strain on the hangers from the countershafts, all of which naturally increase the friction losses.

With belt drive the speed of a machine must remain practically constant, except in the case of lathes or other machines where gearing and cone pulleys are utilized to effect changes, while with motor drive a wide range of speed, suited to varying conditions is quickly and easily obtained. This feature alone adds to the sum total of the efficiency of the machine and widens its scope of work, saves time in transferring and setting up work, and results in a general saving of time, power and cost.

Speed range in connection with many machine tools is all-important, as the machine is often subjected to rough and ill usage at the hands of the operative, which causes abnormal strains upon the controlling apparatus; this must be so constructed as to be able to withstand the severe conditions which are imposed on it through inexperienced or careless manipulation and yet be reliable of operation, easily accessible and of simple construction.

In selecting a motor for driving machine tools it is of great importance that the conditions affecting the machine it will drive are thoroughly understood and allowance must be made for abnormal conditions which may at times be imposed upon it. In the case of a machine which operates at very nearly the same load under all conditions a shunt-wound motor may be used, but if the load varies at different periods, is light at one part of the operation and heavier at others, a compound-wound motor is required.

The careful selection of motors for drive in a plant devoted to the manufacture of hardware specialties is just as essential as in industries where more attention is usually given the question



Group of Punch Presses and Other Machines in Hardware Factory.

of power applications, and the choice should not be made until every point in connection with the demand on the machine has been carefully considered.

Some machine tools are now being built with the motor an integral part of the machine itself or with bosses cast on the frame and planed off ready for drilling for any motor base that the purchaser may wish to install for driving the machine. There is, too, apparently an effort on the part of manufacturers to bring the dimensions of standard sizes of motor frames within a certain limit to better facilitate mounting on machinery, due to the varied demand for different motors for certain machines.

An indication of the economies that can be effected in the average plant by substituting central-station service for isolated-plant operation, is well illustrated in a hardware factory in Chicago. In this case the comparison between the operation at present and under the former conditions is particularly significant because central-station service replaced a gas-producer plant.

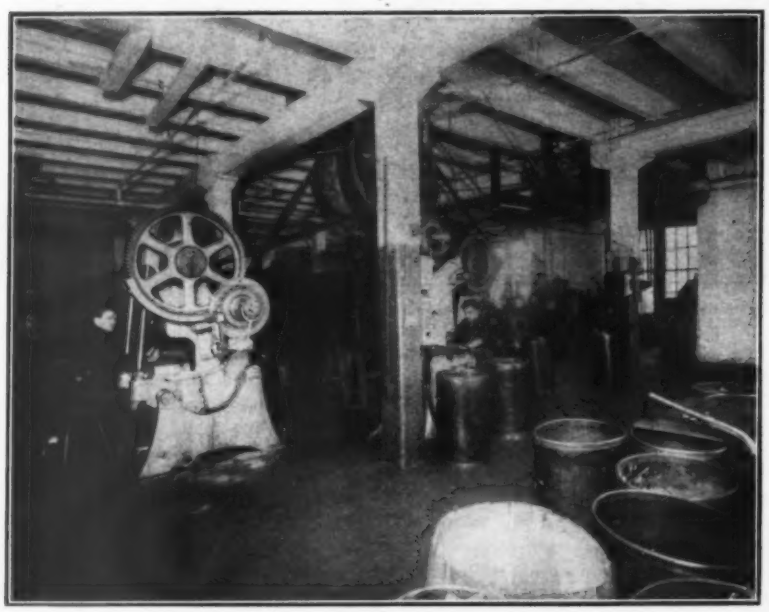
It may be of interest to describe briefly the equipment that was replaced, and which had been installed for only about four years when the change was made. The gas producer was of the suction type, equipped with coal charging elevator and scrubber, and rated at 150 horsepower. This producer supplied three prime movers, each direct-connected to a direct-current generator. The installation comprised one 55-horsepower Rathburn vertical three-cylinder gas engine, operating at 360 revolutions per minute direct-connected to a 30-kilowatt generator; one 85-horsepower gas engine of the same type, running at 280 revolutions per minute and driving a 55-kilowatt generator; and one 100-horsepower engine, 289 revolutions per minute, direct-connected to a 75-kilowatt generator. Current was generated at 230 volts and a storage battery was employed to maintain constant voltage. Connections were also made with the city gas supply for emergency service to the gas engines.

Group of Motor-Driven Tumblers.

In soliciting the adoption of central-station service by this plant, the engineers of the Commonwealth Edison Company made a careful analysis of operating costs. For the current year the costs were found to be $6,391.53 divided as shown in the accompanying table.

YEARLY OPERATING COSTS.

Salary of engineers—$13.50 per week		$ 780.00
Salary of firemen		260.00
Fuel, 375,350 lbs. coal at $6.10 per ton		1,143.35
Removal of ashes (dumped into vacant low property)		
Water, 570,000 cu. ft. at 52.5c		300.00
Oil, waste, etc., pro-rated from general oil account		50.00
Repairs to engines and producer		288.53
Depreciation: 15 per cent storage battery, $900.00	$ 135.00	
Depreciation: 10 per cent producer and gas engine $15,035.00	1,503.50	
Depreciation: 5 per cent building, $1,800.00	90.00	
Depreciation: 5 per cent miscellaneous installation		
		1,878.50
Interest 5 per cent on $20,643.99 investment		1,032.15
Taxes, 1.5 per cent on $10,000.00		150.00
Insurance (no decrease since change of service)		
Gas bills for year (emergency service)		150.00
Rental value of space occupied by engines and gas-producer plant		369.00
Yearly operating costs		$6,391.53



Motor-Driven Punch Presses.

In connection with the salary of the fireman it should be stated that this is pro-rated as he devotes only about one-half his time to actual power-plant duties. No mention is made in this report of depreciation, maintenance or interest on the motors as this is practically the same under both conditions. It is interesting to note that the manufacturer himself placed the rental value of the space previously occupied by the gas-producer plant at $369 per year and subsequent developments have proved this figure to be conservative.

During the year covered by the figures there were a total of 166,840 kilowatt-hours used, making the net cost per kilowatt-hour, $0.0383. Figured on this energy consumption the rate for Edison service, on the alternating-current scale, would have been $0.0344, a saving of $0.0039 per kilowatt-hour. This, of course, does not take into consideration the many advantages of central-station power such as uniform

Hardware Manufacturing Data—Sheet No. 1.

The term load-factor is used in these data in such a sense that a load-factor of 100 per cent represents the use for twenty-four hours every day of power corresponding to the rated capacity of the motors connected. An operating-time load-factor of 100 per cent represents the use of the rated capacity of the motors for the running hours per day specified for each installation.

Lawrence Brothers' Manufacturing Company, Sterling, manufacturers of builders' supplies and hardware.

Total connected horsepower, 233. Total number of motors installed, 23.

There are also installed two 20-kilowatt Toledo electric spot welders.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is 220 volts, 60 cycles, three-phase.

No.	Horse-power	Speed R. P. M.	Application.
1	15	850	With nine-inch pulley belted to 38-inch pulley on line shaft in machine room where the dies, tools, etc., are made. There are four shapers; two sensitive drills; one 24-inch drill press; one 3-foot radial drill press; one 24-inch planer; one 24-inch lathe; three 4-inch lathes; one speed lathe; one 30-inch band saw; one die grinder; one tool grinder; one 36-inch band saw; one 14-inch buzz planer; one 12-inch wood lathe.
1	7.5	850	With 9-inch pulley belted to 36-inch pulley on line shaft to which are belted two special bull dozers used for making trolley barn-door rails.
1	10	840	With 9-inch pulley belted to 24-inch pulley on line shaft to which are belted one bull dozer for bending trolley barn-door rails; one forming roll; two sheet-metal punch presses; one sensitive drill.
1	20	685	With 10-inch pulley belted to 34-inch pulley on line shaft to which are belted two staple-making machines; two barn-door hook-making machines; two hinge pin-cutting machines; one hinge pin roller; two double-headed emery tool grinders.
1	10	840	With 10-inch pulley belted to 34-inch pulley on line shaft to which is belted one special No. 70 Bliss bull dozer for making barn-door rail covers out of No. 14 sheet steel. This bull dozer exerts a pressure of 300 tons.
1	10	840	With 9-inch pulley belted to 38-inch pulley on line shaft to which are belted one No. 32 Toledo Machine & Tool Company punch press for fastening knobs on cupboard door locks; one Long & Allstatter punch press for making part of window lock; one No. 31 punch press for cutting large hinge in two; one pipe-strap-making machine; one press that punches two hinges in each operation.
1	5	840	With 6-inch pulley belted direct to a 48-inch fly-wheel on Farrel Foundry & Machine Company punch press which is used for punching two-inch barn-door rollers out of 0.25-inch sheet metal.
1	5	1,120	With 6-inch pulley belted to same as above. Not being used when data were obtained.
1	5	1,140	With 6-inch pulley belted direct to 26-inch pulley on punch press which is used for punching strap hinges.
1	10	840	With 9-inch pulley belted to 36-inch pulley on line shaft on which are belted one No. 3 punch for punching small strap hinges; one No. 3 punch used as cutting shears for cutting No. 6 sheet iron 4.5 inches wide; one small special bull dozer for curling hinge preparatory to connecting two ends of hinge together; one No. 3 small press for cutting splices; one 16-inch lathe.
1	10	840	With 9-inch pulley belted to 36-inch pulley on line shaft to which are belted one No. 3 punch press for making screen-door handles; one No. 3 punch press for cutting part of barn-door hanger out of $\frac{1}{8}$-inch sheet metal; one Williams & White No. 14½ punch press; one No. 3 punch press; one No. 2 Williams bull dozer; one John Adte & Son $\frac{3}{8}$ riveting machine.
1	10	840	With 9-inch pulley belted to 36-inch pulley on line shaft to which are belted one No. 7 punch press for making staple plates; one No. 32 punch press for punching tug splices; one Grant Manufacturing Company spinner riveter for rivetting window locks; one National Machinery Company horizontal punch for stamping 1.5-inch washers; two small Cincinnati Machinery Company bull dozers; one small rivetting machine; one $\frac{3}{8}$-inch punch press; two drill presses; one lathe for planing barn-door roller wheels; one centrifugal Japaner.

Hardware Manufacturing Data—Sheet No. 2.

No.	Horse-power	Speed R. P. M.	Application.
1	20	685	With 10-inch pulley belted to 44-inch pulley on line shaft to which are belted one No. 31 Toledo drill press; one small drill press; one reamer for counter-sinking screw holes in strap hinges; one 16-inch double-head emery grinder; one rivetter for rivetting barn-door hanger; three 10-hole reamers for reaming strap hinges; two rivetters for large hinges; three double-head horizontal bull dozers for fastening hinges together; one No. 32 Toledo punch press; one No. 31 Toledo punch press for curling hinges; one No. 32 Toledo punch press for curling hinges preparatory to fastening together; one 12-inch junk-cutting shears.
1	10	840	With 9-inch pulley belted to 36-inch pulley on line shaft to which are belted one No. 31 Toledo punch press for cutting off small door-lock springs; one No. 32 Toledo punch for bending part of window lock; two 6-head gang drills; three hinge-assembling machines; one small tapping machine; one drill press used for tapping hinges; one No. 31 Toledo punch press for mounting head on hinge; one horizontal reaming machine for reaming holes where pins in box hinges belong; two automatic double reamers for hinges; one hinge-assembling machine; one hinge broacher for large hinges.
1	25	850	With 12-inch pulley belted to 24-inch pulley on line shaft to which are belted one 6 by 6 Gardner air compressor (air is used for sand blasting and cleaning motors); one 8-volt 1,500-ampere, and one 10-volt 750-ampere, direct-current generators; current so generated is used in electroplating department.
1	5	1,140	With 8-inch pulley belted to 12-inch pulley on jack shaft to which are belted one 30-inch band saw; one 12-inch cut-off saw.
1	3	1,130	With 4.5-inch pulley belted to 10-inch pulley on jack shaft, 6-inch pulley on line shaft to 16-inch pulley on water pump.
1	15	850	With 8.5-inch pulley belted to 48-inch pulley on line shaft to which are belted seven large rattlers; one small and one 24-inch exhaust fan.
1	0.5	1,130	With 2.5-inch pulley belted to 4.75-inch pulley on 24-inch Sturtevant exhaust fan in enamelling room.
1	15	850	With 12-inch pulley belted to 36-inch pulley on line shaft to which are belted six double-head buffers; one 24-inch blower in buffing room. Line shaft runs through wall into electroplating room to which are belted four plating cups; three double-head wet buffers; one small barrel rattler.
1	3	1,130	With 4.5-inch pulley belted to 34-inch pulley on line shaft to which are belted one paper-box folding machine; one paper-box scoring and cutting machine; one paper shears.
1	11	Variable	Elevator motor on freight elevator.
1	8	750	Elevator motor on freight elevator.
2			20-kilowatt Toledo electric spot welding machines which are capable of welding together two 0.25-inch pieces of sheet metal. These are used to good advantage not only saving time, but fastening together the metal better than by rivets.

The above data have been obtained while the punches, bull dozers, etc., were doing the work mentioned, other different dies for punches being placed in the above machines when different material is being manufactured.

Hardware manufacturing plant located in Chicago manufacturing furniture hardware, such as bed trimmings, locks, handles, etc. Plant operates 10 hours per day.

Total connected horsepower, 165.75. Total number of motors installed, 46. Average kilowatt-hours per month, 18,458.

Kilowatt-hour consumption for 12 months:

Month	Kilowatt-hours	Month	Kilowatt-hours	Month	Kilowatt-hours
November	11,870	March	21,513	July	19,000
December	19.990	April	17,021	August	20,900
January	21,300	May	20,500	September	20,500
February	24,000	June	11,400	October	13,500

Load-factor, 20 per cent; operating-time load-factor, 43 per cent.

Hardware Manufacturing Data—Sheet No. 3.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is 220 volts, direct current.

No.	Horse-power.	Speed R. P. M.	Application.
1	15	1,200	Driving one sprinkler pump.
1	4	1,100	Geared to one house pump.
1	2	1,275	Belted to Ingersoll-Rand air compressor.
2	0.5	....	Each direct-connected to a 1000-pound Duntley hoist.
1	1	1,800	Belted to exhaust fan.
1	15	....	Direct-connected to freight-elevator mechanism.
1	0.5	1,500	Driving one drill press, used on light work.
1	2	1,200	Belted to punch press.
1	3	1,250	Driving one wire-bending machine.
1	3	1,000	Belted to line shafting driving seven drill presses; and one 12-inch emery wheel.
1	5	900	Belted to line shafting driving one drill press; four punch presses; one tap machine; one 12-inch emery wheel; and one spring-coiling machine.
1	3	1,200	Belted to line shaft driving four punch and stamping presses.
1	5	1,600	Belted direct to one large spring-coiling machine.
1	5	1,200	Belted to line shafting driving six punch and forming presses; one shearing machine; and one riveting press.
1	7.5	850	Belted direct to one forming punch press.
1	10	800	Belted to line shafting driving two punch and forming presses.
1	5	1,100	Belted to line shafting driving six riveting machines; two four-spindle tapping machines; and one small drill press.
1	2	800	Variable-speed motor driving punch press.
1	10	1,275	Driving heavy punch press.
1	3	800	Driving punch press.
1	2	800	Variable-speed motor driving punch press.
1	2	1,000	Driving punch press.
2	2	800	Each driving punch press.
1	10	800	Driving heavy punch press.
1	5	800	Driving punch press.
1	1	1,000	Driving punch press.
1	0.75	1,000	Variable-speed motor driving turret lathe.
1	4	800	Belted direct to straightening roll.
1	7.5	1,000	Belted to line shafting driving 16 tumbling drums.
1	1	1,500	Belted to forge blowers for four fires.
1	2	1,200	Driving one medium drill press.
2	1		Each driving small drill press.
1	0.25	1,000	Driving small drill press.
1	1	600	Driving engine lathe.
2	1.5	600	Each driving engine lathe.
1	5	9,00	Driving one milling machine.
1	3	1,000	Driving one milling machine.
1	2	1,200	Driving one milling machine.
1	1	800	Driving one milling machine.
1	3	1,000	Driving one shaper.
1	0.25	1,000	Driving one jigger.
1	4	1,800	Driving emery grinders.

Hardware plant making casket handles, etc.

Total connected horsepower, 35. Total number of motors installed, 9. Average kilowatt-hours per month, 3,098.

Kilowatt-hour consumption for 12 months:

October	3,190	February	3,791	June	3,235
November	3,661	March	4,188	July	2,099
December	4,815	April	3,389	August	1,548
January	2,386	May	2,873	September	2,997

Load-factor, 16.2 per cent; operating-time load-factor, 34 per cent.

MOTOR INSTALLATION.

The following is a list of the motors with their respective drives. Supply source is three-phase, 60 cycles, 220 volts.

No.	Horse-power.	Speed R. P. M.	Application.
1	5	1,120	Belted direct to one Champion exhaust fan.
1	5	1,120	Belted direct to polishing lathe.
1	5	1,120	Belted to 20-foot shaft driving two three-wheel polishing lathes; and one two-wheel lathe.
1	0.5	1,400	Belted to a Root positive pressure blower.
1	0.5	1,400	Belted direct to scratch brush.
1	10	1,120	Belted direct to 1,500-ampere, six-volt plating generator, 525 revolutions per minute.
1	3	1,120	Belted to line shaft driving one doweling machine; one 10-inch rip saw; one air compressor; and two slitting shears.
2	3	1,120	Each belted direct to a four-wheel polishing lathe.

speed, absence of break-down troubles, etc., which have since been enjoyed at this plant.

The actual energy consumption of the plant during the first year of central-station service was as follows: November, 11,870; December, 19,990; January, 21,300; February, 24,000; March, 21,513; April, 17,021; May, 20,500; June, 11,400; July, 19,000; August, 20,900; September, 20,500, and October, 13,500, making the total for the year 221,494. This consumption, which earned a lower unit rate than that originally quoted, was based on an installation of 165.75 horse-

Motor Direct-Connected to Boring Mill.

power in motors, 16.24 kilowatts in lighting units and two electric furnaces, the total connected load being 144.84 kilowatts.

Individual drive is used throughout this plant, with the exception of the small punch presses, riveting machines and a few other small machines, all located in one department on the second floor. The 16 tumbling drums are also group driven, a 7.5-horsepower motor, 1,000 revolutions per minute, being used. Full data on the detailed motor installation are given in the accompanying data sheets.

Views of the installation are shown in the illustrations herewith.

Gas-Filled Lamps for Streets.

Co-operating with storekeepers and other citizens of Needham, Mass., the Edison Electric Illuminating Company of Boston is introducing nitrogen-filled street lamps, which together form a white way on the town's principal business street.

Since January 1 the company has installed 186 units of 400 watts each, four of 500 watts, and 43 of 750 watts, from which an income of about $10,000 a year will be derived.

The company furnishes a fixture consisting of an acorn-shaped spun-glass top with opal glass, for which the customer pays $24, a lamp of either 400, 500 or 750 watts being included. Because of the ready response on the part of citizens to the company's offer, the business district of Needham is one of the best lighted of any town in the neighborhood of Boston.

Lehigh Valley Section April Meeting.

W. K. Buckingham, electrical inspector for the Lehigh Valley district of Pennsylvania, made the principal address at the April meeting of the Lehigh Valley Light & Power Company Section of the N. E. L. A., held in the Fairview Auditorium at Allentown, Pa.

Chairman Irving Samuels introduced Mr. Buckingham. The speaker prefaced his remarks by giving a clear and concise exposition of the principles and objects of the work taken up by the Underwriters' Association. The various systems and methods adopted for the efficient handling of the large number of inspections was explained and conclusions were drawn showing the entire justification of the work from the widely divergent viewpoints of the consumer, the central stations and the insurance companies.

Following Mr. Buckingham's address, R. C. Dornblaser, chairman of the Question Box Committee, presented the report of that committee on many queries relating to the subject of the Underwriters' rules and inspections. A spirited discussion which uncovered a wealth of information was taken part in by Messrs. Buckingham, T. T. Fogel, A. P. Schneider, and others.

Southern Power Company to Build New Generating Station.

Southern Power Company, one of the Duke electric properties, has let to the Hardaway Construction Company a contract for the construction of a 30,000-horsepower hydroelectric generating station on the Catawba River, and power will be generated under a 50-foot head.

Just below the new plant is the 32,000-horsepower station of the company and below this another 32,000-horsepower station. The completion of the new station will give Southern Power Company approximately 100,000 horsepower generating capacity within a few miles on the Catawba River. The new station will contain five generating units.

Increased Electrical Rates for London.

Directors of the leading electric companies in London have held a conference and decided upon an advance in the rates for electric current to take effect at once. The reason for the advance is the increased cost of production because of the war, especially the increased cost of coal. The companies announced that rates would be lowered again at the earliest possible moment.

Addition to Minneapolis Plant.

Work has been started by the Minneapolis General Electric Company on the installation in its Riverside station of a new 15,000-kilowatt steam turbine unit which will be used for reserve purposes. The improvement will more than double the capacity of the station and will enable the company to insure that the demands upon its service are given proper care.

Commercial Practice
Management, Rates, New Business

POWER DEVELOPMENT METHODS FOR IOWA CENTRAL STATIONS.[1]

By Edward Soukup.

Before any real measure of success in building of power load can be obtained, the reliability of the service furnished must be assured and the confidence of the public built up. It must first be demonstrated that reasonably continuous service can be kept up; people are apt to judge the company by the lighting service given, and no opportunity should be lost in making it evident that the lighting service is reliable. If your lights go out occasionally, due to neglect, the manufacturer will rightly believe that your power service will also be neglected, and he will hesitate, even though the price is favorable. Also the community must have confidence in the men back of the enterprise and in its representatives, confident that they possess the disposition and the means to take proper care of the requirements of the public. Most of the trouble which has developed between the operators of central stations and the municipalities has been due to the lack of appreciation of the necessity for reliable service and the loss of public confidence. In the campaigns for power consumers, a reputation for good service will be found invaluable and it is worth every effort to cultivate the confidence of the public by giving real and efficient service.

In preparing a campaign for power business it is advisable to make a list both of power consumers already connected and prospective consumers, and to analyze the power requirements of each one. To keep in touch with consumers already connected indicates an interest in their affairs which is usually appreciated by the customer and is really the most efficient method of holding on to the business already obtained. It also prepares the way for increases of load by the customer when his business grows to a point where additional power is needed. I believe that half the time of the power salesman can be profitably spent with the consumers already connected, and that their requirements should be looked after first. Another advantage of keeping in touch with the customer is that when properly looked after, he will always be a booster for your service.

The list of prospective consumers should be carefully canvassed and the favorable ones relisted as an active list, to which special attention should be given. In such cases where the prospect is using a large amount of power generated by his own equipment an elaborate study of conditions should be made and a report presented showing the conclusion arrived at. Permission should be secured to make a test of power under operating conditions and to make an analysis of power costs. Ordinarily it is found that most of the machinery is driven through a large amount of belting and shafting from one or two engines, meaning a large friction loss, sometimes running to 50 per cent of the actual power developed. A steam indicator is connected up and indicator cards taken throughout the run, for a day or two, or a week if necessary, until conditions are pretty well determined. Data are also tabulated regarding the operation of each machine and the output of each is determined as closely as possible.

While the manufacturing load opportunities are scarce in Iowa, it is true that many of those which are available present very desirable characteristics. The cereal mill industry is becoming well developed throughout the state, and grist mills, flour mills, food product manufactures, and starch factories are beginning to flourish. Usually they operate at least 10 hours per day and not uncommonly run on a schedule of 24 hours per day. This means high load-factor and makes a most desirable addition for any central station; also a low rate is necessary but there are numerous instances of success in this direction. This class of business is bound to build up on account of the great production of agricultural products and there is no reason why the central stations should not do their share in the development of this class of industry. One feature of the cereal business is that it usually is not subject to depressions and is pretty nearly continous. Another industry closely allied with agriculture is the creamery. There are many of these scattered over the state but are usually located at some distance from lines. The load-factor of these will approximate 20 per cent, and with mechanical refrigeration in addition will run better than this. As a day load this class of business is very desirable.

The very extensive increase in the number of automobiles is having its effect on the good roads movement and we may look for considerable action along these lines. Building of permanent roads requires large quantities of sand and rock and ought to act as a stimulus to these industries. In Cedar Rapids we have a number of stone quarries and sand dredges connected to our lines and we find that these make very good off-peak consumers. Operation usually commences in March, reaches maximum during the summer and continues well along into November. Owing to the exposed weather conditions under which quarries and sand conveyors are operated, an isolated plant depreciates very rapidly or else large investment for buildings is required. These conditions favor the electric drive and special stress should be laid on the durable and reliable characteristics of electric motors, as well as to the low first cost.

The brick and tile industry presents much the same summer load characteristics and from that point of view is desirable. However, owing to the drying requirements, many brick plants seem to think that steam plant is the most economical because of the utilization of exhaust steam for the drying room. However, the development of the waste-heat system for brick drying has very largely overcome this disadvantage and an increasing number of brickyards are being motor driven. One undesirable feature of this class of business for small central stations is the large size of the individual motors, starting or stopping of which produces a bad effect on voltage regulation.

In the construction of buildings electric power is becoming more and more widely used, and is of great convenience to the contractor. We find that small motor-driven saws installed on the job save many trips to the planing mill. Electrically-driven floor

1 From a paper presented at the annual convention of the Iowa Section, N. E. L. A., at Keokuk, Iowa, April 20-22.

scrapers and concrete mixers are other examples of the use of motor-driven apparatus, used freely. During the construction of a concrete bridge at Cedar Rapids last year, electric power was used almost exclusively for pumping water from pier foundations and for concrete mixing, about 10,000 kilowatt-hours being consumed.

The small motor business is growing rapidly, although in this line the surface of the field has barely been scratched. This is the ideal field for the small station and it is going to be a big factor in the central-station business. All have had experience with the washing machine motor, vibrator, the sewing machine motor and the electric fan, but there are some others which deserve more attention and which produce more revenue. I wish especially to call attention to the vacuum cleaner, the electric house pump, the exhaust fan or pump, and the automobile battery-charging outfits.

Vacuum cleaners are desirable because they are used only during the day time and because no additional investment is required to furnish service. Ordinarily they are used for a short time every day, particularly during the morning and do not affect the peak load in any way. A small cleaner using, say, 80 watts an hour or so a day will use up two or more kilowatt-hours a month, and a larger cleaner more in proportion. We find that very little attention is required in the way of repairs and for that reason the cleaner is justly popular among customers. Large stationary systems are being installed in flats and apartment houses, but ordinarily their use is limited by the landlord to one or two hours a week.

Private water supply systems with automatic electric control are now being pushed by manufacturers and we have quite a few connected to our lines. The ordinary family requires five to six thousand gallons of water per month, and the power required to pump this quantity will make a material addition to the energy consumption. These systems are not very expensive and find ready sale among the fairly prosperous residence owners.

Exhaust fans are almost a necessity for restaurant kitchens and owing to the fact that they operate almost continuously during the day, have a high load-factor. If not operated at any other time, they are at least run during the noon hour and in this way take some of the dip out of the noon drop on the load curve. These exhaust fans should be pushed among the cigar stores and pool rooms where the air is filled with tobacco smoke; in the bakeries to cool the air; in the picture shows and in the churches and public buildings. The ventilation of churches is becoming a matter to which considerable attention is paid, particularly among the new churches and we find that a few of these fans help out the Sunday load curve.

Another line which shows great promise for the future is the electric operated irrigation system for truck gardeners. We are not in position as yet to report the results of actual operation of any of these systems but from information at hand some interesting developments are expected. While rainfall is as a rule plentiful, it does not generally come at the time desired and gardeners have found that artificial supply supplementary to rainfall is a great help in forcing early crop development. A sprinkler system is installed to cover the desired area and supply of water is furnished as needed. The amount of power required is usually 5 to 10 horsepower, depending upon the size of the garden, and the service is off-peak. These irrigation systems ought to have an important bearing on the financial success of rural line extension.

During the past five years the Cedar Rapids company has devoted considerable time and effort to increasing the use of electric vehicles. A special power rate for individual charging outfits has been established and the company has encouraged local auto men to push the sale of electric passenger cars. The electric car has so many features which appeal to the women that the success has been due to these features and to the simplicity of operation. These cars are usually charged from mercury-arc rectifiers which are also so simple to operate that any woman, once instructed, can attend to this duty alone. We have today about 60 individual charging plants for passenger cars, and about as many more electrics are being charged at three electric service stations. As a rule these pleasure cars are charged at night after the peak is over, and as the average load of each will run about two kilowatts, the aggregate makes a very favorable showing. Our arrangements with service stations provide for operation after 9:00 o'clock so that this portion is strictly off-peak.

I question whether any future discussion of the problem of load development will be complete without including the subject of electric cooking. Our experieice along this line has been limited—due to natural caution—but our own experiments have resulted favorably and we hear much the same thing from other places. A few years ago the solution of the electric cooking problem seemed to be in the application of the fireless-cooker principle in order to conserve the heat and to reduce the energy consumption but today we seem to be getting away from this idea and the stoves are being built along the same lines as gas stoves, heating plates and ovens, with perhaps a fireless cooking chamber attached. This development has been due to the fact that in order to be successful the stove must be capable of satisfying all demands for frying, cooking, baking and warming ovens, just the same as the old coal range. The public wants this kind of a stove in preference to any other.

About two years ago we connected four electric cook-stoves to our rural extension and our records show during that time an average consumption of about 75 kilowatt-hours per month. These stoves were of the combined fireless cooker and hot-plate type, and the consumption would be somewhat lower than with the regular range type. The stove used has a capacity of 2,300 watts, as against 3,000 to 5,000 watts of some of the other ranges. One of these customers has lately installed a range type stove and his consumption has increased considerably. The rate charged for this service is 4.5 cents per kilowatt-hour net.

In sections where gas service is not available the only serious impediment to a wide sale of these stoves is the original cost, for it seems that the expense of operation is considered very reasonable by the consumers themselves. We have made no particular campaigns for this kind of business as yet but it certainly is a tempting field.

Business Survey in Boston District.

A thorough canvass of the 42 cities and towns in the Boston Edison Company's territory is being made. Every house, store, factory or other building is visited by a representative who ascertains the situation electrically—whether Edison service is installed, what hindrances there are to its introduction, and what physical conditions exist to make wiring easy or difficult.

This being ascertained, the representative shows the tenant or holder how a house or building not so provided can be wired, how the wiring can be paid for on the installment plan of monthly payments, and how the work can be done without tearing up or marring walls, floors or ceilings.

The canvassers are showing the farmers in the rural districts how they can introduce motor service for pumping water, grinding feed, sawing wood, cutting hay, milking cows; the process of hatching chickens by electricity, and a dozen other processes formerly accomplished by hard labor. Motorization of factories is another objective of the small army of canvassers engaged in this work.

Electrical Construction

BUSINESS HINTS FOR DEALERS.

By G. D. Crain, Jr.

Get After Fan Trade Early.

The early bird catches the worm, and the dealer who wants to get his share of the electric fan business should not wait until the temperature gets up in the nineties. He should begin working for fan business early enough to have his prospects lined up, at least, so that he can close them at the first hint of summer weather.

A dealer who has been working for the past month for fan trade used a simple and inexpensive plan. He distributed blotters in all the banks and other public places, bearing his name and address, and carrying the comprehensive announcement, "Electric Fans For Sale, For Rent, Exchanged, Repaired."

This got his name and announcement before a lot of people who might not have thought of him otherwise, and will insure attention from a great many a little later on.

The Guarantee on Used Motors.

A dealer who has made a specialty of handling used motors believes that the business can be made just as solid and substantial as the sale of new equipment, provided the concern which buys and sells uses the right methods.

In his opinion these consist, first, of thoroughly overhauling the motor before it is put out, so as to know that it is in first-class condition, and, second, guaranteeing the motor to do the work for a definite period. The guarantee is not made to cover as long a period as if a new unit were being sold, but it is specific and ironclad, covering the operation of the motor for 60 or 90 days, as a rule.

"Putting the motor in good condition is not only going to insure satisfaction to the customer," this dealer pointed out, "but it is the only way in which a guarantee can be given. And as the guarantee helps to sell the motor you can see that the thing works in a circle.

"It is certainly poor business to put out a defective piece of equipment. It means repossession, and repossession means expense. I figure that it costs me at least $5 to take back a motor which has been sold and has failed to make good. The cost of drayage and installation, not to mention the selling expense, is easily that. Consequently it is to my interest, as well as that of the user, to have the motor running perfecty when it is sold, and that is the only way I would consider handling business on used equipment."

Make Use of Publicity Matter.

The dealer who is handling a lot of well advertised goods, as most electrical merchandise is, is overlooking an asset if he does not utilize the advertising matter which is furnished by the manufacturer. This material costs money, and it can be made to make money for the dealer in the form of profitable sales. Get it, and when you have it, use it, which means to display it where it can be seen—in the windows, in connection with displays of the goods; on the counters and elsewhere inside the store.

In one store the dealer has a big section of his wall reserved for the posting of advertising placards. The background consists of dark green burlap, and the space is cut up by narrow strips of wood, so that the placards are attractively framed and set off. When he gets cards carrying the announcements of the makers regarding the goods which he has on sale, he places one of them in this space, and people who come in the store are immediately confronted with this bulletin board, as it were, of the latest and best in the electrical merchandise field.

You never hear this dealer kicking about slow business, because he doesn't experience it. His own aggressive sales methods, coupled with the intelligent use of the expensive and effective publicity matter of the manufacturers, insure good trade with him all the time.

"I would no more throw away this advertising matter," he declared recently, "than I would destroy postage stamps. Both cost money, and both are necessary to the operation of this business."

Co-operative Credit Plans.

Credit losses are the bugbear of every business, and the house which is most successful in eliminating them, or rather cutting them down to the irreducible minimum, is the one which is going to have the largest net on the volume of business which it handles.

Electrical supply houses have been finding it to their advantage to use a co-operative plan of keeping posted on credit conditions and on the operations of small contractors who have not yet established themselves on a solid basis, and who are entitled to a limited line of credit.

"The way the thing works, if it is not properly kept under control," said a supply man, "is this: John Jones will come in and ask for $100 worth of credit. He is a good fellow, though without much financial backing, and on the strength of what I know of him I agree to let him have this much stuff. Then he goes to some other supply house, and on the basis of the fact that I have extended credit, he gets an account opened there. Then he can take bills and invoices from these two to other supply houses, showing that he is being credited, and induce them to extend a line. The result is that he will soon have credits amounting to several hundred dollars, when his limit should be $100.

"By means of exchanging information on such matters, however, the various supply men are able to protect themselves and each other, and the contractor who has not yet reached a point where he is entitled to a large line is restricted to the amount of material he can actually pay for."

That this is good policy is indicated by the fact that the well established contractor often complains of the competition offered by the new men breaking into the business, and of the ease with which they get the supply houses to finance their operations by supplying material. With the plan referred to above in mind, it is evident that such operations are now being kept within bounds.

Change Your Displays.

The electrical dealer, like other merchants, can interest the public which sees his window displays only by changing them frequently and putting in live matters all the time. If he allows a particular trim to remain in for a long while, those who pass by will conclude that the window is not worth attention, and will cease looking at it. Even the dealer who is somewhat out of the beaten track, and who may imagine that not enough people can see his windows to make effort in that direction worth while, will find that if he gives the subject attention he will be able to get business through his displays.

There is a certain electrical concern located on a street which is not the best retail location in its town, by any means. In fact, it would be pronounced a rather poor one, from most merchandising standpoints. Yet this house does a good retail, over-the-counter business, and it gets most of it by window displays. It changes them at least once a week, and sometimes oftener. The result is that those who do pass nearly always take a look at the window, appreciating the fact that something of interest is going to be displayed there.

This store happens to be a few doors from an intersection where a good many street-car transfers are made. There is nothing so tedious as waiting for a car, and the people who have to spend the time doing this have got in the habit of stepping back and looking in the windows of the electrical concern. It is remarkable how many times such "looks" result in sales. The suburbanite who sees a display of flash-lights remembers that he has been intending to get one, and goes in and buys, between cars. Or he sees an attractive lay-out of Mazdas and realizes that it is time he was replacing the carbon lamps in his home. The window display is often just the suggestion that is needed to change an intention into action, and furnish the buying impulse. In this way it makes the advertising of the manufacturer and dealer effective in a concrete and definite way.

Meeting of Iowa Electrical Contractors.

The fourth semi-annual convention of the Iowa Electrical Contractors' Association was held at Keokuk, Iowa, April 20, 21 and 22, during the days of the convention of the Iowa Section of the National Electric Light Association and the Iowa Street and Interurban Railway Association. At the opening session on Tuesday morning S. W. Moorhead, mayor of Keokuk welcomed the delegates to the city and commented on the electrical development of the Mississippi River Power Company. Floyd A. Wallace, vice-president of the association, who presided in the absence of W. C. McCarten, replied to the welcome and reviewed the activities of the association during the past year. J. T. Marron, of Rock Island, as a member of the Executive Committee of the National Association, spoke of the work that is being done to raise the standards of electrical contracting and make the business more profitable to those engaged.

At the afternoon session L. F. Knapp, of Keokuk, presented a paper entitled "The Turbine in the Production of Electrical Energy." This paper reviewed the development of the water turbine with brief descriptions of present types. The comprehensive investigations carried on by the Mississippi River Power Company before determining upon turbines for use at Keokuk were described and data given on the operation of the units installed.

L. T. Block, of St. Louis, then delivered an address on the workman's compensation law and liability insurance, dealing particularly with conditions which have resulted from the enactment of the existing Iowa statute and emphasizing the necessity for making adequate provision for meeting unusual expenses in case of accident. He referred also to the liability policies of the Utilities Indemnity Exchange.

E. J. Burns, secretary of the Illinois Electrical Contractors' Association, then delivered an address outlining the work which has been done by the Illinois Association. He mentioned the educational work which the organization has undertaken to standardize estimating so far as possible and also of personal visits which are made to central-station companies to establish harmonious relations with the electrical contractors. On these visits the central stations are convinced that the contractors are able and willing to operate display rooms and handle the sale of appliances, as well as the solicitation of house-wiring contracts.

A talk on the "Value of Local Associations" was then made by C. L. Walker, secretary of the Tri-City Electrical Contractors' Association. Mr. Walker presented an outline of the activities of the Tri-City organization which holds periodical meetings to discuss important local topics. To these meetings representatives of the central station are invited and an effort is made to promote harmonious relations in handling appliances and wiring.

Following this discussion an interesting paper was presented by H. J. Ryan, of Sioux City, entitled "Estimating Methods." The paper dealt principally with the experiences of the company with which Mr. Ryan is connected. A standard estimate blank is used which conforms somewhat to that of the National Electrical Contractors' Association except that a column is left blank adjacent to the estimated items in which the actual cost figures are placed when a job is completed. These records are then filed and form a permanent record of each job.

The subject of bookkeeping systems for electrical contractors was then discussed by George W. Hill, of Utica. The H & W accounting system was described and its advantages pointed out. Mr. Hill called attention to the necessity for an absolutely accurate accounting system and the necessity for knowing exactly the amount of cash and stock on hand every 30 days.

At the session on Wednesday afternoon Floyd A. Wallace, of Des Moines, presented a paper on "State Legislation Affecting Electrical Contractors." This paper described a new law in Iowa which empowers municipalities to regulate the electrical contracting business. The exact manner in which this should be done is left to the discretion of each municipality and city councils may require contractors to furnish bond, be licensed, or can enforce such inspection laws as they deem advisable.

The work of the Co-Operative Protective Committee of Iowa was outlined by Edward Kunkel, of Davenport. This Committee considers all matters of abuses reported by contractors and endeavors to raise the standard of electrical work to a point where it will be better paying to the contractors and at the same time reduce fire and accident hazards. The State Protective Committees work in conjunction with the national committee of the National Electrical Contractors' Association.

An address was then delivered on relations between central stations and contractors by M. T. Humphrey, of Waterloo. Mr. Humphrey outlined numerous co-operative schemes whereby the contractor can become a valuable asset to the central-station company. He held that the contractors should do all soliciting for house wiring and handle exclusively the solicitation and sale of domestic appliances. Contractors should also report to the central station any complaints in service or irregularities and work in conjunction with the utility in spreading the gospel of electric service. On the other hand the central station should devote its time and money to educating the public to higher standards of electrical construction.

At the afternoon session on Wednesday the election of officers took place which resulted as follows:

President, Floyd A. Wallace, of Des Moines.

Vice-president, W. L. Fowler, of Cedar Rapids.

Secretary-Treasurer, M. T. Humphrey, of Waterloo.

George O. May, of Sioux City, was re-elected director for three years, the other members of the Board of Directors being E. H. Sabine, of Des Moines, and Edward Kunkel, of Davenport.

The meetings on Thursday were held in conjunction with the meetings of the Iowa Section of the National Electric Light Association.

Among the Contractors.

An electrical department is a new addition to the Ambridge Hardware & Plumbing Company, of Ambridge, Pa. The concern is contemplating adding a full line of electrical supplies and fixtures, besides taking in contracts for house wiring. John R. Long, an electrical engineer, formerly of Tarentum, Pa., will have charge of the new department.

National Association of Electrical Inspectors.

THOMAS HENRY DAY, President, 59 Deerfield Avenue, Hartford, Conn.
H. S. WYNKOOP, Vice-President, Municipal Building, New York, N. Y.
WILLIAM LINCOLN SMITH, Secretary and Treasurer, Concord, Mass.
JAMES E. COLE, Representative on Electrical Committee of National Fire Protection Association, City Hall Annex, Boston, Mass.

Executive Committee
EUGENE N. DAVIS, Chairman, Brookline, Mass.

SECTION REPRESENTATIVES:
C. H. Fletcher, H. Burnes, British Columbia.
A. W. Hopkins, G. W. Perry, Western New England.
Washington Devereux, A. H. Lilley, Philadelphia.
E. N. Davis, H. A. Knight, Eastern Massachusetts.
C. A. Hannan, O. E. Smith, New York City.
C. W. Mitchell, John W. Carrell, California.

MEMBERS AT LARGE:
George L. Collison, James B. McCarthy, Frank R. Daniel, Thomas D. MacColl, James H. Fenton, A. A. Moffitt, F. G. Hartwell, R. P. Strong, J. E. Latta

"LET THE CODE DECIDE."

Secretary's Message.

The Secretary has again to apologize for allowing this matter to appear under the old Association heading, but not having as yet received the list of Executive Committee members appointed at large, he has been unable to assemble the complete data for a correct heading.

He also regrets the small number of replies to the questions appearing in this number. He realizes that the time was hardly long enough for replies to reach him from either the California or Vancouver Section representatives, and when their replies do come in they will be given in a supplementary list.

It is a little disheartening, however, when 18 copies of a bulletin are sent out headed "The new list of members of the Executive Committee appointed at large not being complete I am unable to send out as large a set of bulletins as usual and it is accordingly desirable that every member receiving this should send me his reply and also send it as promptly as he possibly can," that two full weeks later only *seven* replies should have come to hand at all. The New York, and Western New England Sections are not represented at all, and had it not been for the replies received from the *elective* officers there would have been an utterly insufficient amount of matter, to make it worth while to use. The Secretary will use his best endeavors to carry on this work as heretofore but they will be perfectly useless without the prompt co-operation of the Executive Committee.

The matter appearing in this section consists of questions on the National Electrical Code, its interpretation and meaning, and questions as to whether certain methods of wiring are in accord therewith. These questions are gladly received from anyone interested, even if not a member; they should be sent to the secretary with any needed elucidating sketch. They are answered by each member of the Executive Committee according to his knowledge of what the ruling would be in his jurisdiction.

It should be understood that no pretense is made to give an authoritative interpretation of the Code. This is a voluntary association; it has representation on the Electrical Committee of the National Fire Protection Association, which prepares the Code, but it has no right, and claims no right, to give a final interpretation of anything in the Code. It is only intended to give the interpretation which seems correct to the members of the Executive Committee. No attempt is made to edit or correlate the answers from the different members of the Committee, as it is felt that the occasional difference of opinion is calculated to lead to a further study of the matter in question, further discussion and the final clearing up of obscure points.

The aim is to help toward a better understanding of the Code on the part of all; a more uniform conception of its meaning; increased precision in applying it; and harmonious action of those using it, for the common good.

Notes From the Sections.

The California Section held its annual meeting on April 10 and elected for the ensuing term:

Arthur Kempston, president, San Francisco; W. E. Brothers, vice-president, Berkeley; George A. Cleary, secretary-treasurer, 914 Merchants Exchange Building, San Francisco, Cal.

Executive Committee: W. A. Spencer, San Jose, and F. R. Ellison, Oakland.

It was decided to hold the next few meetings at the Exposition Grounds, selecting each time certain special exhibits so that the members could familiarize themselves with the most recent advances in the electrical field. The first of these meetings will be held on May 8.

The New York Section held its annual meeting on April 12 and elected for the ensuing term:

George E. Bruen, president; G. O. Jenney, vice-president; J. Coghlan, 123 William Street, secretary-treasurer; O. E. Smith and M. L. Pomares, representatives on Executive Committee National Association.

Section Executive Committee: H. S. Draper, F. J. Fitzpatrick, James D. Lynett, David Lawson, and C. E. McIntyre.

Membership Committee: A. M. Eveison, J. T. Wilson, H. L. Cornell.

Sign Flasher Boxes.

Question 295. The requirement for flasher boxes located on or within metal sign structures is that metal must be not less than No. 28 United States sheet-metal gauge. What must be the thickness of metal for such a box which is located apart from the sign, for instance, in the store?

Answer 1(E). While it would not appear that there is a specific rule governing this question, I feel it would be right to class such an inclosure as being a metal cabinet and if used within a building should require the thickness of the metal to conform to the specifications of Rule 70*f* for a cabinet of similar size.

Answer 2(P). I should say one-eighth inch if of cast metal or No. 16 United States sheet-metal gauge if of this type under Rule 70*f*.

Answer 3(F and G). Sign flasher should be inclosed in approved cabinet and hence the metal should be at least as thick as for switch and cutout cabinets—No. 16 United States sheet-metal gauge under Rule 70*f*. This extra thickness is required to protect the flasher from mechanical injury to which it is not liable when placed in a sign.

Answer 4(N). I do not see why this is not covered completely by Rule 19*d* taken in connection with Rule 70*f*.

Answer 5(H). The thickness of the metal of the box which may be necessary depends somewhat upon the location and liability to injury. As a general rule, I should say at least the thickness of approved cabinets, but always at least 25 per cent thicker than No. 28 United States sheet-metal gauge.

Answer 6(A). I do not see any rule covering this except Rule 83*b*, third paragraph. This gives the thickness and does not state that it shall be changed if the flasher is located in any other place than in the sign.

Answer 7(O). The inclosure for

these flashers may be of No. 28 gauge only when it forms a part of the sign. When mounted separately, Rule 19*d* specifically requires that they be inclosed in approved cabinets, which means regular approved and labeled cabinets as used for switches and cutouts.

Grounding Motion-Picture Machines.

Question 296. The old style motion-picture machine had a wooden bed plate which served as an insulator. The modern machines have metal frames instead. Should the modern machine be required to be grounded; if so, under what rule?

Answer 1(E). I do not feel that any part of a motion-picture machine should be grounded. It should be remembered that most of these machines stand upon an insulated floor.

Answer 2(P). The modern machine should be grounded under the general intent of the Code to secure the grounding of all non-current-carrying metal parts of electrical apparatus and fittings. For illustrations see Rules 1*c* 8*a* and 28*f*.

Answer 3(F and G). We do not know of any rule bearing on this subject, nor do we believe the insulation point was considered in the first instance.

Answer 4(N.) I do not think the Code specifically covers this point. It is covered implicitly. The report of the Committee on Theater Wiring adopted in New York changed Rule 38*u*, paragraph 1, and substituted in part "Arc lamps must be constructed so far as practicable in accordance with the requirements of No. 38*k*, 1, 2, 3, 4, and 6." Rule 38*k*, 4, reads "Must be constructed so that neither live parts nor carbons will be brought into contact with metal of hood during operation, and arc-lamp frames and standards must be installed and protected so as to prevent the liability of their being grounded."

If, then, the arc-lamp frame, etc., is an integral part of the machine structure the latter should not be grounded, and if it is not there is no need for grounding it anyway.

Answer 5(H). The rules relating to grounding of generators and motors would seem to carry the idea of protection to persons from an electrified mass of metal composing the frame and I see no reason why the same principle should not apply to the frames of these machines.

Answer 6(A.) The Code does not have a rule directly covering this question. It does, however, have rules controlling the wiring and if these are followed I do not think it necessary to ground the frame.

Answer 7(O). It is quite probable that the old style machine referred to is not an approved type and hence should not be used at all. Under no circumstances should the frame be grounded, but according to Rule 38*k*, 4, the frame and standard should be so installed as to prevent any liability of their becoming grounded.

Fuses on Current Transformers.

Question 297. Current transformers burn out when the secondary is open-circuited. This peculiarity operates to prevent the placing of fuses in the secondary. Fuses cannot of course be placed in the primary. How is this condition met by inspectors of the various departments, in view of Rule 23b, paragraph 1.

Answer 1(E). I have found sealable fuses on the primary side of the potential transformers to solve this problem.

(Secretary's Note.—In a brief note accompanying his replies, which got to me Friday a. m., "E" stated there was to be a wedding at his house on the Saturday following. This should sufficiently account for his replying as if the question referred to potential instead of current transformers.

Answer 2(P). In this territory we waive Rule 23*b* because we cannot apply it to this special case.

Answer 3(F and G). The wiring attached to the secondary of a current transformer is under normal conditions always a closed circuit, the coils of which carry current in exact proportion to the current flowing in the primary. A short-circuit in the secondary would not result in any appreciable rise of current and owing to this fact fuses in the secondary would be of no value as they are only used to protect against excess current.

If the primary is not fused it is fair to presume that fuse protection is not necessary, due to the impedance of the circuit. If it is fused, then the secondary wiring is automatically taken care of and the installation is in accordance with Rule 23*b*.

Answer 4(H). As the current ceases to flow through the secondary when it is open-circuited, and fuses are to protect against excess current, if no current is on the circuit, why bother about fuses?

Answer 5(A). I cannot see where Rule 23*b* has any bearing on this subject.

Answer 6(O). I can see no reason why anyone should wish to place fuses in either the primary or secondary of the current transformer, nor do I see how Rule 23*b* applies.

Answer 7(N). I do not think Rule 23*b* applies at all, because the only place you get these is in connection with ammeters which must on account of line voltage or some other reason be insulated from the circuit in which the current is to be measured and in buildings these will be found on switchboards of central stations, substations or isolated plants, in any case falling under Rules 2 and 3. It is true Rule 2*d* requires in other respects the rules of Class C apply, but also Rule 3*e* refers to the wiring of instruments, etc., on switchboards, the last clause of which limits fuses to not over two-ampere capacity. Now, since practically all of these transformers run about five amperes for full-scale deflection, evidently that cannot refer to current transformers. Further, in any such case the station protective devices will prevent dangerous rise of current in the line, and it will never reach an amount in the secondary to do more than destroy the instrumental precision.

It is one of those cases where Code fusing requirements do not apply and never were intended to apply, because the very thing the fuse is meant to bring about—the prompt rupture of the circuit under excess current, is in this case the precise source of the danger, namely, excessive and dangerous rise in the secondary voltage liable to cause breakdown of the transformer insulation.

Publishers Entertained by Transcontinental Telephone.

An interesting feature which distinguished the annual dinner of the members of the American Newspaper Publishers' Association, which was held at New York on April 22, was the exchanging of greetings and speeches between that city and San Francisco, Cal., over the transcontinental telephone wires of the American Telephone & Telegraph Company. Each of the 600 guests were provided with head-piece receivers, and after listening to a cornet solo played at the Panama Fair in California, there was an exchange of greetings and speeches between Mayor Mitchell of New York and the civil and exposition officials at San Francisco.

It is understood that 250 men were busy at various points along the transcontinental telephone line, employed directly in keeping the wire open between New York City and San Francisco, and that more than $2,000,000 worth of apparatus of the telephone company was involved in the entertainment.

Electrical Engineering Problems.

By R. G. Hudson and W. V. Lyon.

DIRECT CURRENTS.

Problem 34.

A direct-current milliammeter has a resistance of 3 ohms and is designed for a full-scale deflection with a current of 25 milliamperes. (*a*) What resistance must be connected in parallel with the milliammeter so that a full-scale deflection of the needle will indicate 50 amperes? (*b*) How much power will be absorbed by the resulting ammeter at full-scale deflection? (*c*) How much current would this ammeter take if connected across a 115-volt line? (*d*) What resistance must be connected in series with the milliammeter so that full-scale deflection of the needle will indicate 150 volts? (*e*) How much power will be absorbed by the resulting voltmeter when connected across a 115-volt line? (*f*) At what point on the series resistance should a tap be located so that a full-scale deflection of the needle will indicate 15 volts? (*g*) If the 150-volt voltmeter is connected in series with a 20-ohm lamp load across a 115-volt line, how much current will the voltmeter take from the line?

SOLUTION OF PROBLEM 34.

Answer to Question a.

Since 25 milliamperes equals 0.025 ampere, the potential drop in the milliammeter at full-scale deflection must be 3× 0.025 or 0.075 volt. Hence the milliammeter must be shunted with a resistance such that when a current of 50 amperes flows through the combined milliammeter and shunt the potential drop in the milliammeter will be 0.075 volt. The current in the shunt under these conditions will be 50—0.025 or 49.975 amperes and the resistance of the shunt by [6] must equal 0.075/49.975 or 0.0015 ohm.

This ammeter shunt may be located within the ammeter box or at some distance from the box. In the latter case the connecting milliammeter leads must be of fixed resistance and must be considered a part of the milliammeter resistance.

Answer to Question b.

The potential drop across the milliammeter being 0.075 volt and the current 50 amperes at full-scale deflection, the power absorbed by the instrument is given by [19]

$$P=50\times0.075=3.75 \text{ watts.}$$

When possible an ammeter should be short-circuited by a short-circuit plug connected in parallel with the instrument. While the saving in power is trifling, the instrument cannot then become overheated and is protected against any short-circuit that may occur on the system.

Answer to Question c.

The resistance of the ammeter is given by [8]

$$R=(3\times0.0015)/(3+0.0015)=0.0015 \text{ ohm (very nearly)}$$

If connected between the line wires of a 115-volt system, the current is given by [6]

$$I=115/0.0015=76{,}700 \text{ amperes.}$$

It is obvious that no ammeter should ever be connected to the circuit in such a manner that the ammeter would be damaged by such a current and line fuses or breakers would be opened.

An ammeter should always be connected in series with the load and never in parallel.

Answer to Question d.

Since a current of 0.025 ampere produces a full-scale deflection on the milliammeter a resistance must be connected in series with the milliammeter which will limit the current to 0.025 ampere when the instrument and the series resistance are connected across a circuit of 150 volts or less. The total resistance of the instrument and series resistance is given by [6]

$$R=150/0.025=6{,}000 \text{ ohms.}$$

If a resistanec of 6,000—3 or 5,997 ohms is connected in series with the milliammeter, the instrument will serve as a voltmeter and a full-scale deflection will indicate a difference in potential of 150 volts between one terminal of the milliammeter and the outer end of the series resistance.

It should be observed that an ammeter consists essentially of a milliammeter shunted by a low resistance, while a voltmeter consists of a milliammeter connected in series with a high resistance. Milliammeters designed solely for voltmeter use have a higher resistance than milliammeters designed for ammeter use, since voltmeters must be of high resistance anyway so that the milliammeter need not have such a low resistance as that cited above. Direct-current voltmeters usually have a resistance of 100 ohms per volt, so that a 150-volt voltmeter would have a resistance of 15,000 ohms, the power loss in such an instrument being lower than that given below.

ALTERNATING CURRENTS.

Problem 84.

A three-phase, 25-cycle, 6,400-volt induction generator has a full-load capacity of 2,000 kilowatts. It is wound for 36 poles. The true resistances of the stator and rotor windings at 25 degrees centigrade when measured between terminals, are 0.558 and 0.0760 ohm, respectively. The ratio of transformation is 6,400 to 2,068 volts. The data taken at no load and with the rotor blocked are given in the following table. The temperature is 25 degrees centigrade:

No load	Line voltage	6,400
	Line current	90
	Power	47,800
Rotor blocked	Line voltage	2,160
	Line current	366
	Power	374,000

Assume that the ratio of effective to true resistance is the same for the rotor as for the stator at a temperature of 25 degrees centigrade. Assume that the running temperature is 80 degrees.

(*a*) What is the approximate value of the slip when this generator delivers its rated load? (*b*) What are the output, the efficiency and the power-factor when this generator is operating at a slip of 2.37 per cent?

Answer to Question e.

The current taken by the voltmeter when connected across a 115-volt circuit is given by [6]

$$I=115/6{,}000=0.0191 \text{ ampere.}$$

The potential difference being 115 volts, the power absorbed by the voltmeter is given by [19]

$$P=115\times0.0191=2.2 \text{ watts.}$$

Answer to Question f.

A resistance must be connected in series with the milliammeter such that a difference of potential of 15 volts will produce a current of 0.025 ampere in the milliammeter. The total resistance must be 15/0.025 or 600 ohms. Hence a tap must be made in the 5,997-ohm resistance at a point where the resistance to the milliammeter terminal is 600—3 or 597 ohms.

Answer to Question g.

The total resistance of the voltmeter and lamp load being 6,000+20 or 6,020 ohms, the current taken by the voltmeter is by [6]

$$I=115/6{,}020=0.019 \text{ ampere.}$$

It should be noted that when a voltmeter is connected in series with the load no serious consequences will result except that lamps will not light and motors will not run. A voltmeter should always be connected in parallel with the load and never in series, although no harm will be done if the latter connection is made.

SOLUTION OF PROBLEM 84.

Answer to Question a.

As with the induction motor it is first necessary to compute the constants of the generator from the data. These are the effective resistance of the stator winding and the true resistance of the rotor winding at the running temperature, the leakage reactance of both windings and the no-load power-factor.

The equivalent single-phase true resistance of the stator winding at 25 degrees centigrade is

$$0.558/2=0.279 \text{ ohm.}$$

The equivalent single-phase true resistance of the rotor winding referred to the stator at 25 degrees is

$$(0.0760/2)\times(6{,}400/2{,}068)^2=0.364 \text{ ohm.}$$

The effective resistance of both windings is

by [4a] $$R=374{,}000/(\sqrt{3}\times366)^2$$
$$=0.93 \text{ ohm.}$$

Let k represent the ratio of effective to true resistance for each winding

$$0.279k+0.364k=0.93$$
$$k=1.45.$$

The effective resistance of the stator winding at 25 degrees is

$$1.45\times0.279=0.404 \text{ ohm.}$$

The amount by which the effective resistance is greater than the true resistance and which varies with the frequency but not with the temperature is 0.404—0.279=0.125 ohm.

The true resistance of the stator winding at 80 degrees is

$$0.279(234.5+80)/(234.5+25)$$
$$=0.338 \text{ ohm.}$$

The effective resistance of the stator at 80 degrees is

$$r_1=0.338+0.125$$
$$=0.463 \text{ ohm.}$$

The true resistance of the rotor winding at 80 degrees is

$$r_2=0.364(234.5+80)/(234.5+25)$$
$$=0.441 \text{ ohm.}$$

The power-factor at no load is

$$\text{Cos } \theta_0=47{,}800/6{,}400\times\sqrt{3}\times90$$
$$=0.0479.$$

The total leakage reactance, X, is

$$X=\sqrt{Z^2-0.93^2}$$
$$Z=2{,}160/\sqrt{3}\times366=3.41 \text{ ohms.}$$
$$X=3.28 \text{ ohms.}$$

The voltage, E, which is used in cal-

DIRECT CURRENTS.

Problem 35.

A 40-ton electric car with its two series motors connected in series runs at a speed of 10 miles per hour on a straight level track and takes a current of 8 amperes from the trolley wire, which is at a potential of 600 volts above the track. The train resistance of this car is $4+0.13S$ pounds per ton, where S is the speed of the car in miles per hour. The combined resistance of the armature and series field of each motor is 0.6 ohm.

Find the current and power taken from the trolley wire and the speed of the car under the following conditions, assuming that the air-gap flux of each motor is proportional to the armature current: (a) motors connected in series, track level, and trolley voltage 500 volts; (b) motors connected in parallel, track level, and trolley voltage 600 volts; (c) motors connected in parallel, track level, and trolley voltage 500 volts; (d) motors connected in parallel, trolley voltage 600 volts, and car ascending a two-per-cent grade. (e) With the motors connected in series, trolley voltage 600 volts, and speed of car 10 miles per hour, what current and power will the car take from the trolley wire when it is accelerated on a level track at a rate of one mile per hour per second?

This problem illustrates the operation of an electric car under various conditions.

ALTERNATING CURRENTS.

Problem 85.

A three-phase rotary converter is rated to deliver 300 kilowatts at 220 volts on the direct-current side. At full load, when operating at a power-factor of 0.90, it has an efficiency of 91 per cent. In the following problem this rotary receives power through transformers from a three-phase, 2,200-volt circuit. The transformers should be rated so that the rotary can operate at 0.90 power-factor when delivering 300 kilowatts without overloading them.

(a) If the transformers are connected in star on both their primary and secondary sides, what should be the kilovolt-ampere rating and the voltage ratio of each? (b) If the transformers are connected in delta on their primary and in star on their secondary sides what should be the kilovolt-ampere rating and the voltage ratio of each? (c) If the transformers are connected in delta on both their primary and secondary sides what should be the kilovolt-ampere rating and the voltage ratio of each? (d) In question (c), if one of the transformers is burned out, what is the greatest kilovolt-ampere input to the rotary that will not overload the remaining transformers? (e) If the transformers are connected in delta on their primary sides and have their secondary sides arranged so that the rotary can supply power to a three-wire Edison circuit, what should be their voltage ratio of transformation?

Answers to the above problems and two new problems will be printed in the next issue.

culating the rotor current is equal to the terminal voltage less one-half of the leakage reactance multiplied by the no-load current.

$$E=6,400-1.64\times\sqrt{3}\times90$$
$$=6,145 \text{ volts.}$$

An approximate value of the slip, which is probably good to within about 10 per cent, can be computed from a formula similar to that used in the case of the induction motor. In this case it is better to use a factor of 1.1 instead of 1.2 as was done when estimating the slip of the motor. This is on account of the difference in the phase relations of the current and voltage in the two cases.

$$s=1.1Pr_2/V^2$$
$$=1.1\times2,000,000\times0.441/6,400^2$$
$$=0.0237.$$

Answer to Question b.

Formulas similar to those used in the case of the induction motor will also apply here. The only difference is that wherever the slip occurs its sign is reversed. The current in the rotor is

$$I_2=E/\sqrt{(r_2/s-r_1)^2+X^2}$$
$$=6,145/\sqrt{(0.441/0.0237-0.463)^2+3.28^2}$$
$$=333 \text{ amperes.}$$

The current in the stator is

$$I_1=\sqrt{I_2^2+I_n^2+2I_2I_n(sX/2r_2-\text{Cos }\theta_n)}$$
$$I_n=\sqrt{3}\times90=156$$
$$sX/2r_2=0.0237\times3.28/2\times0.441$$
$$=0.088$$
$$I_1=\sqrt{333^2+156^2+2\times333\times156\times0.040}$$
$$=373 \text{ amperes.}$$

As in the case of the induction motor the power transferred from the rotor to the stator is

$$P=I_2^2r_2/s$$
$$=333^2\times0.441/0.0237$$
$$=2,065 \text{ kilowatts.}$$

The power output is this less the copper loss and the no-load core losses in the stator.

The copper loss in the stator is

$$I_1^2r_1=373^2\times0.463$$
$$=64.5 \text{ kilowatts.}$$

Since there are no data showing how the total rotation losses are divided between friction and windage and core losses we will assume that they consist entirely of core losses. They equal the input at no load less the copper loss in the stator winding, and are

$$P_r=47,800-156^2\times0.404$$
$$=38 \text{ kilowatts.}$$

(The effective resistance of the stator winding at 25 degrees centigrade is 0.404 ohm.)

The power output is

$$P_o=2,065-64.5-38$$
$$=1,963 \text{ kilowatts.}$$

This shows that the approximate formula for the slip gives a result only about 2 per cent too small in this case.

The input is equal to the power transferred across the air gap plus the copper loss in the rotor.

$$P_i=2,065+333^2\times0.441$$
$$=2,114 \text{ kilowatts.}$$

The efficiency is

$$\eta=1,963/2,114$$
$$=92.8 \text{ per cent.}$$

The power-factor is

by [2a] $$PF=1,963,000/6,400\times373$$
$$=0.822.$$

Lighting of Small Interiors.

At the meeting of the Chicago Section of the Illuminating Engineering Society held on April 22, J. R. Cravath presented a paper entitled "Knowns and Unknowns in the Lighting of Small Interiors." This paper was a conservative review of our present knowledge of this subject as considered in the three important phases of how it affects the comfort of the eye, the physical efficiency of the installation, and esthetic tastes.

The manner in which the comfort of the eye is affected depends on the distribution of brightness in the range of vision. Light sources so situated that they throw no light into the eye do not influence comfort of vision unless reflected rays therefrom enter the eye, as from glossy paper. There is great variation between individuals as to what kind of lighting is regarded as comfortable. The clear blue sky, whose brightness is about two candlepower per square inch, is usually entirely comfortable when viewed outdoors with green or gray fields forming the ground surface; if such a sky is viewed through the window from the rear of an office, the contrast due to the dark border about the bright window soon becomes uncomfortable. Consequently the contrast that a light source makes with its visible surroundings affects its comfort, as well as does its intrinsic brightness. Modern high-efficiency sources have very great brightness, ranging from about 3,000 candlepower per square inch for bare gas-filled tungsten lamps to 2 to 8 candlepower per square inch for a frosted vacuum tungsten lamp. Even the latter makes a strong contrast to the walls and ceiling of a room and is therefore not comfortable when looked at directly. Shades, globes and bowls used in direct and semi-direct lighting range from about 6 to 0.075 candlepower per square inch in brightness. Extensive tests indicate that any exposed source in the steady line of vision and having a brightness in excess of one candlepower per square inch is not comfortable. In Mr. Cravath's opinion this maximum should better be not over 0.5 candlepower per square inch for continued comfort.

It is necessary to take account not only of the direct light from sources, which becomes very important within the range about 25 degrees from the normal line of vision, but also of light reflected from paper and other glossy working surfaces. The latter is diminished by using diffuse lighting instead of concentrated light sources. There is no question but that diffuse lighting is much more comfortable. It is desirable to provide as much of the light needed as possible by diffuse general lighting and, if this is not practicable on account of economy, to supplement the general lighting by means of localized light properly screened and directed. The common arrangement of leaving the light concentrated on a bright working area with the rest of the room in practical gloom is not good because the contrasts are too great; some people find this cozy, however. The eye was not evolved under such conditions. Another important feature is direction of the light so as to avoid confusing or annoying shadows. Diffuse lighting avoids this and may relieve improper direction of the light.

The physical efficiency of a lighting installation depends on the color of walls, ceiling, furniture and floor, the shape of the room, the character of the reflector or globe equipment, and the location of the light sources. The influence of colored walls and of reflector efficiencies is quite well known. The relative amount of wall and ceiling space as determined by the shape of the room affects the efficiency considerably. Center location of light sources is generally more efficient than mounting them on wall brackets. Mr. Cravath gave efficiency figures for different lamp and reflector equipments in a typical living room. In offices the decrease of illumination due to dust and soot accumulation on reflectors is about 11 per cent per month in cities where soft coal is extensively used.

Esthetic considerations are difficult to summarize on account of the great variation of artistic taste. To most people, however, artificial light sources that are deficient in yellow and red rays are unpleasant because they give a ghastly effect to the features. Most agreeable effects are produced by having sufficient yellow in the light. Unpleasant, sharp and harsh shadows are produced by unidirectional light; diffuse lighting is greatly superior in this regard, as its shadows are softer. Some people like the whole room bright, others only the reading or dining table; some object to a bright ceiling, others wish to see some bright lights, etc. The matter of taste is largely one of education.

In the discussion of the paper there participated M. G. Lloyd, A. Scheible, C. A. Luther, R. F. Schuchardt, Harry S. Gradle, A. O. Dicker, H. D. Butler, J. A. Hoeveler and others.

Michigan Section Convention.

The annual convention cruise of the Michigan Section, National Electric Light Association will be held June 26 to 30 on the Steamer *Rochester*. The trip will be made on Lake Huron, Lake Superior and Lake Michigan. Herbert Silvester, 18 Washington Avenue, Detroit, Mich, is secretary of the Section.

Iowa Section, National Electric Light Association.

Fifteenth Annual Convention, Keokuk, Iowa, April 20, 21 and 22, 1915.

Both in point of business accomplished, and in social activities, the fifteenth annual convention of the Iowa Section, National Electric Light Association, held at Keokuk, Iowa, April 20, 21 and 22, was the most successful of any previous meeting of this organization. The subjects proposed for discussion were planned to cover a diversity of topics pertinent to Iowa utilities, and the interest manifested and the full discussions stimulated, is an indication of the completeness of the program. Experiences with high-efficiency gas-filled lamps, practices in serving rural customers, and the small customer business, were topics that were accorded considerable attention. Rate-making and workmen's compensation, were also thoroughly discussed, the former in a very able paper by F. A. Warfield, of the Illinois Traction System.

The stability of the electric central-station industry is reflected in the report of the Committee on Facts and Factors, reproduced in tabulated form herewith, which shows that, almost without exception, customary increases were made in business and revenue during the past year.

The first session was called to order on Tuesday morning by Rufus E. Lee, of Clarinda, president of the Association, who introduced Dr. S. W. Moorehead, mayor of Keokuk. Dr. Moorehead expressed the pleasure of the citizens of Keokuk in having the convention meet there, and referred to the mammoth hydroelectric plant of the Mississippi River Power Company, in which the city justly takes considerable pride.

President Lee then presented the annual address, reviewing the progress of the industry in Iowa, and commenting on the increases which have been made, despite the depression in other industries. He spoke of the developments in incandescent lamps during the life of the Association, this being represented by an efficiency of four watts per candle 15 years ago, as compared with 0.5 watt candle today. He also called attention to the growing tendency to consolidate small properties and serve communities from high-tension transmission lines. Mention was made of the recent agitation for concentric wiring, and this was commended by Mr. Lee. He also spoke of the probability of commission regulation in the state, and urged that utilities prepare for such regulation by establishing equitable rates and adopting uniform systems of accounting.

The report of the secretary-treasurer, was presented by R. H. Fowler, assistant secretary, in which it was urged that a permanent paid secretary be employed, to devote his entire time to Association affairs. Various committees were then appointed, and reports of other standing committees received.

Tuesday Afternoon Session.

At the afternoon session a paper was presented by E. M. Walker, of Dubuque, entitled "Mazda C Street Lighting Lamps and Fixtures." This paper commented particularly on the new type of refractor designed to be used in connection with high-efficiency incandescent lamps for street lighting, and recounted the experiences of the Union Electric Company, of Dubuque, with these units. There are at present 580 600-candlepower type C lamps of the compensator type used for street lighting in Dubuque, which replaced an installation of 480 6.6-ampere arc lamps. The new units are burned on an all night, every night schedule, and their performance was reported as being entirely satisfactory to both the company and the community. The installation was completed the latter part of 1914, and the total burn-outs to the present time have aggregated only 93 lamps.

This paper was followed by one entitled "Mazda C Lamps," by Henry Schroeder, Harrison, N. J., which was read by Fred Benson, of Chicago. This paper presented statistics on incandescent lamp development during the past few years, showing that in 1908 there were a total of 60,000,000 lamps sold. In 1914 this had reached a total of 100,000,000 lamps, with the tungsten lamps predominating. The design and construction of the gas-filled, incandescent lamp, was described and central-station companies were urged to conduct campaigns for the installation of these units. The author stated that at present these lamps were made to burn only in a pendant position, although lamps could be furnished, when desired, for burning in an inverted position. It is claimed by the author that the revenue from these lamps justifies the expense of the campaign, and, in fact, it has been found desirable by many central stations to furnish renewals without cost. The electrical dealers have had marked success in selling the new units, and, with the co-operation of the utilities their sale can be greatly increased. It is estimated that during the past year the excess revenue to central station companies from installations of type C lamps has reached the figure of $15,000,000.

The discussion was opened by A. L. Dodd, of Charles City, who reported success of an installation of 50 series type C lamps, which are burned in an inverted position. The ordinary radial-wave reflector is used, and no provision made for protection from the weather.

In reply to a question as to furnishing of free renewals, Mr. Benson stated that the revenue from the large sizes of type C lamps has been sufficient to justify some of the larger companies furnishing free renewals. This is also true of the vacuum-bulb incandescent lamp in 60-watt sizes and larger. Mr. Lee reported that the Clarinda company makes a uniform charge of 20 cents for either 40 or 60-watt tungsten lamps. Other companies reported similar charges for renewals.

E. M. Walker, of Dubuque, brought out a point which he believes should have considerable bearing on the question of units for street-lighting service. In March, 1914, the energy consumed by the 480 arc lamps then installed, was 75,000 kilowatt-hours, while the consumption for March, 1915, of 615 type C lamps, 580 of 600 candlepower, and 35 of 400 candlepower, was only 59,000 kilowatt-hours. The reduced consumption makes the installation of the incandescent lamps profitable.

The discussion then turned to whiteway lighting, and various opinions were expressed as to the desirability of making further installations of four or five-light clusters. These have become so universally employed that their advertising value has considerably decreased, and it was the consensus of opinion that a single-light standard equipped with the new high-efficiency lamp would be much more effective. In replying to questions as to all-night burning in localities where the practice has been to turn out four of the lights and burn one from midnight to daylight, it was suggested that either alternate lamps could be turned out, or smaller vacuum-bulb lamps could be installed in the same globe with the larger lamp without affecting the location of the latter or interfering with the effective distribution of light. These could be burned from the time the larger lamps were turned off until daylight.

Thomas Ferris, of Osage, thought that frequently in small towns the main

streets were well lighted at the expense of the outlying sections. He advocated keeping within the tax limit allowed for street lighting.

Thomas Crawford, of Clinton, reported that 100-watt type C lamps were used in Clinton, with marked success. These lamps are placed on posts spaced 60 feet apart and served by steel-taped cable, the installation costing only 75 cents per front foot.

Prof. A. H. Ford, of Iowa City, thought that it was good practice to limit the space between posts to the distance between curbs of the street to be lighted.

The question of workmen's compensation was then taken up, Thomas Crawford, of Clinton, presenting a brief outline of his experiences with the new Iowa law as an introduction to the discussion. Mr. Crawford commented on the Iowa law, stating that no allowance was made for employers in case of accident to an employee who was found to be suffering from organic trouble. The Clinton company has always made a practice of allowing full time to employees injured, and in addition paying all doctor and hospital bills.

H. C. Blackwell, of Davenport, called attention to one phase of the workmen's compensation law, with which he has had personal experience. Employees under the law cannot sign away their rights to compensation, and, therefore, persons having any physical defects involve a hazard to the company because of their liability to receive injury. This worked a hardship on the company in the case of one employee who was injured, and although able to return to work was permanently disabled. It was the consensus of opinion that in cases of this kind the utility should endeavor to secure a position for the employee in some other field, rather than continue him in the service of the company.

The report of the Committee on Possibilities of Business from Rural Transmission Lines was then presented by W. H. Burtis, of Decorah. This report contains a summary of replies received in answer to questions submitted to the central stations of the state. These replies indicate that the practice of Iowa central stations is to serve farmers when the business and conditions warrant it and have the farmers pay the cost of such line, although they should be owned and maintained by the company. The same rates should be charged for rural service as for corresponding service in the city, but a higher monthly minimum charge should be made than in urban communities. The service should be metered separately for light, power and cooking, metering from the secondary side.

It was recommended in the answers that groups of farmers incorporate and take over the business of distributing the energy to a number of farmers, the current being sold to the corporation at a somewhat lower rate than the city retail rate, and some officer of the corporation should be made responsible. From the experiences of companies already serving rural customers it is found that serious consideration should be given the question of core losses in transformers. It is pointed out in conclusion that many farmers are paying from $300 to $700 for individual lighting systems of one kind or another, and, while many of these isolated plants are satisfactory the farmers could form groups and obtain electric service from a transmission line with a much smaller investment and have very much superior service.

In the discussion H. C. Blackwell, of Davenport, urged that the question of core loss be given consideration in rates for rural business. He also called attention to the necessity for adequate protection of rural lines from lightning and storms, pointing out that trouble on rural lines serving only a few consumers will occasionally affect city lines serving power customers.

H. W. Young, of Chicago, explained that while it would be possible to eliminate the core losses by metering energy on the primary side of the line, this practice is somewhat unsafe, and not to be recommended generally. Also there is considerable trouble from potential transformers, and their cost is high.

Rufus Lee, of Clarinda, mentioned a rural line operated by his company, comprising a single-wire grounded return operating at 2,200 volts, and using 25-foot poles and No. 6 wire. This construction is exceptionally economical and has given satisfaction, although no experience has yet been had with lightning discharges. In reply to questions Mr. Lee reported that the line parallels a grounded telephone line on the same highway, and no troubles have developed.

Wednesday Morning Session.

A paper entitled "Basic Principles of Rate-Making for Central Stations" was presented at the session on Wednesday morning by F. A. Warfield, rate engineer of the Illinois Traction System, Peoria. Mr. Warfield pointed out that a rate to be satisfactory must be easily calculated, understandable by the customers, and return a fair rate of profit on all classes of service. He thought that a wholesale rate is justifiable only when reduced costs are evident. He stated that normal costs of service are the basis for making the charges.

One of the causes for the spread of municipal ownership, he thought, is the impossibility of many utilities to explain just why a particular rate is charged. This leads the customer to believe that the charge is an arbitrary one, made with the sole idea of returning an attractive profit. The true theory of rate-making is that every customer pay his share of the costs incurred in serving him, and to properly analyze these costs it is essential that proper bookkeeping and accounting methods be employed.

Mr. Warfield discussed going value and valuation, from the standpoint of utility, and urged greater uniformity in rate schedules. He called attention to the importance of apportioning costs to the various branches of the service, and emphasized the fact that each branch should bear its own operating charges plus its share of the interest charges. In this connection he discussed consumer cost, demand cost, and output cost. Further comment will be made on this paper in a subsequent issue.

A. L. Dodd, of Charles City, in the discussion, asked if it were advisable to make a rate to a new customer lower than the cost, anticipating that the added load will reduce the costs to such a point that the rate quoted will be satisfactory to the company. Mr. Warfield replied that average rates are determined from minimum and maximum costs, and it is never desirable to go below the minimum figure.

A paper was then presented by E. T. Hughes, contract agent of the Union Electric Company, Dubuque, entitled "Controlled Flat Rates." This paper deals with the experiences of the Dubuque company in its campaign to secure the small customers. A controlled flat rate has been established by the Union Electric Company for the past 16 months, and the results have been very gratifying. It is pointed out that by establishing a flat rate and installing current-limiting devices on the customers' premises the central-station company is permitted to obtain the business of residences that it would be impossible to secure with the meter rate. The limiting devices are installed the same as meters, and have given no trouble. The rate in Dubuque specifies the use of 25-watt tungsten lamps, at one cent per watt of maximum demand, with a minimum charge of $1.00 per month. It has been found by tests conducted by the company that the flat-rate consumer uses his installation an average of three hours per night, and by connecting meters to typical installations it has been found that the revenue for kilowatt-hour received from such customers ranges between nine cents and 20 cents per kilowatt-hour. Flat-rate customers are uniformly satisfied, and all bills are paid in advance, which eliminates considerable bookkeeping and collection costs. During the year 1914, 1,100 new customers were secured for flat-rate service, and

FACTS AND FACTORS OF IOWA CENTRAL STATIONS.

COMMERCIAL STATIONS.

	Station Number	Population of District	Number Consumers per 100 Population	Station Rating, Kw.	Station Rating per Capita, Watts	Station Rating per Employee, Kw.	Ratio, Station Rating to Connected Load, per cent	Average Load During Operation, Kw.	Ratio of Average Load to Station Rating, per cent	Annual Load Factor, per cent	Operating Load Factor, per cent	Investment per Kilowatt of Rating	Investment per Capita	Gross Income per Kilowatt of Rating	Gross Income per Consumer	Gross Income per Capita	Gross Income per $100 Invested	Gross Income per Kw-hr. Made, Cents	Ratio, Expense to Gross Income, per cent	Earnings from Operation per $100 Invested, Interest and Depreciation not Deducted	Total Hours of Operation per Year
	Factor No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
GROUP I	1	340	13.0	20	59	20	133	2.5	12.6	11.5	20.0	$200	$11.75	$ 66.70	$30.30	$ 3.92	$33.30	10.5	129.0	−$9.52*	5,050
	2	450	33.3	35	78	35	87	.....	.....	.....	.....	114	8.90	85.70	20.00	6.67	75.00	....	80.0	15.00	2,190
	3	500	24.0	25	50	12	38	3.8	15.1	15.1	15.1	200	10.00	120.00	25.00	6.00	60.00	9.1	73.3	16.00	8,760
	4	500	20.2	22	44	11	...	.....	.....	.....	.....	381	16.80	119.50	26.00	5.26	31.30	....	103.0	−0.95*	.....
	5	540	25.9	35	65	17	50	5.5	15.7	7.0	7.0	228	14.80	92.80	23.20	6.01	40.60	6.7	72.8	11.00	8,760
	6	700	16.4	60	86	60	60	5.5	9.2	....	....	117	10.00	66.70	34.80	5.71	57.15	8.3	50.0	28.57	8,760
	7	750	16.7	75	100	25	214	3.8	5.1	10.1	15.2	160	16.00	38.70	23.20	3.87	24.10	13.2	74.2	6.25	5,840
	8	750	19.7	75	100	37	...	14.4	19.2	....	....	179	17.85	74.50	37.70	7.45	41.70	8.1	118.3	−7.61*	4,800
	9	800	12.5	22	28	22	55	11.4	51.8	14.8	57.0	454	12.50	159.00	35.00	4.38	35.00	13.5	51.4	17.00	2,280
	10	1,000	20.0	80	80	40	59	9.0	11.2	17.3	22.5	187	15.00	86.50	34.60	6.92	46.10	11.4	74.8	11.63	6,750
	11	1,000	20.5	90	90	90	...	.....	.....	.....	.....	172	15.50	65.40	28.70	5.88	38.00	....	58.3	15.85	8,760
	12	1,200	18.6	75	62	25	125	.....	.....	.....	.....	160	10.00	84.40	28.40	5.26	52.60	....	79.2	10.91	8,460
	13	1,300	19.2	100	77	33	...	.....	.....	.....	.....	250	19.23	91.00	36.40	7.00	36.40	....	26.4	26.80	6,570
	14	1,340	9.9	135	101	45	90	5.7	4.2	....	....	48	4.85	25.90	26.30	2.61	53.85	7.0	78.5	11.55	8,760
	15	1,400	17.9	120	86	40	133	8.7	7.3	10.9	14.5	83	7.15	50.00	24.00	4.28	60.00	10.5	83.3	10.00	6,570
	16	1,450	31.4	130	90	33	...	.....	.....	.....	.....	130	11.70	101.00	28.90	9.07	77.40	....	88.7	8.82	8,760
	17	1,509	17.3	90	60	15	45	18.1	20.1	23.6	35.0	144	8.70	91.40	31.80	5.48	63.30	7.7	83.7	10.40	5,910
	18	1,500	13.9	115	77	38	48	16.0	13.9	29.8	34.0	200	15.35	62.80	34.80	4.82	31.40	5.9	76.7	7.35	7,680
	19	1,500	26.7	125	83	25	36	.....	.....	.....	.....	200	16.70	128.00	40.00	10.66	64.00	....	87.5	8.00	8,700
	20	1,600	23.7	115	72	29	70	13.0	11.3	13.3	13.7	225	16.30	117.30	35.60	8.43	51.90	12.2	74.0	13.65	8,500
	21	1,700	20.6	175	103	58	67	23.0	13.1	26.4	33.0	135	13.90	67.40	33.70	6.95	50.00	7.3	83.4	8.35	7,000
	Average 1915.	1,040	20.1	82	76	34	82	10.0	15.0	16.3	24.3	189	13.00	85.40	30.40	6.03	48.74	9.4	78.4	10.46	6,943
	Average 1914.	1,290	15.9	86	67	34	70	17.0	20.3	19.8	32.6	219	13.15	93.70	34.70	5.35	42.80	10.3	75.8	11.06	5,960
	Average 1913.	1,416	14.2	88	61	28	56	20.2	26.6	....	30.2	216	10.93	93.28	31.96	5.43	51.51	11.6	66.6	18.51	4,871
	Average 1911.	1,415	11.9	82	62	36	94	19.4	26.3	....	33.8	205	11.03	84.30	48.20	4.33	43.50	10.9	73.4	6.23	4,840
	Average 1909.	1,600	10.0	67	42	27	94	.....	....	....	36.0	236	10.00	94.00	37.00	4.06	38.00	....	70.0	.....	.....
GROUP II	22	2,200	....	150	68	37	67	30.0	20.0	33.0	33.0	100	6.82	90.90	.....	6.20	90.90	5.2	73.3	24.25	8,760
	23	2,300	13.1	180	78	60	75	10.6	5.9	11.2	11.5	222	17.40	79.40	47.40	6.22	35.70	15.9	49.1	18.20	8,520
	24	2,300	17.8	140	61	35	38	21.4	15.3	22.5	23.8	178	10.90	110.80	37.80	6.74	62.00	8.8	77.5	14.00	8,260
	25	2,500	15.2	150	60	21	38	25.7	17.1	28.5	28.5	400	24.00	120.00	47.40	7.20	30.00	8.0	75.0	7.50	8,760
	26	2,900	15.7	190	65	38	26	14.9	7.8	15.0	15.0	225	14.74	62.40	26.00	4.09	27.70	9.1	63.7	10.05	8,760
	27	3,000	22.5	225	75	45	80	13.5	6.0	15.0	15.0	209	15.70	83.60	27.90	6.26	40.00	15.9	66.9	13.26	8.760
	28	3,000	11.7	400	133	80	...	.....	.....	.....	.....	90	12.00	45.00	51.40	6.00	50.00	....	50.0	25.00	8,760
	29	3,000	21.9	160	53	27	...	41.7	26.0	27.8	27.8	250	13.30	126.20	30.80	6.73	50.50	5.5	59.5	20.50	8,760
	30	3,000	17.7	335	112	56	84	62.0	18.5	33.8	34.4	105	11.67	48.10	30.40	5.37	46.10	3.0	66.0	15.65	8,600
	31	3,000	18.5	150	50	30	54	40.8	27.2	27.2	28.6	300	15.00	140.00	37.80	7.00	46.70	6.2	80.9	8.90	8,350
	Average 1915.	2,720	17.1	208	75	43	58	29.0	16.0	23.8	24.2	208	14.15	90.64	37.43	6.18	47.96	8.6	66.2	15.73	8,629
	Average 1914.	2,640	16.9	154	58	32	34	28.2	19.6	26.7	27.0	238	13.77	101.90	33.80	5.67	44.00	6.8	72.6	12.40	8,620
	Average 1913.	2,437	16.6	163	67	36	43	27.1	16.7	....	27.4	201	12.88	105.40	41.53	6.76	58.10	8.0	75.6	16.46	8,573
	Average 1911.	2,650	12.7	157	60	29	55	28.4	25.1	....	33.0	190	10.61	83.20	37.40	4.52	41.90	5.7	76.1	8.39	7,620
	Average 1909.	2,470	10.0	122	44	38	48	.....	....	....	....	221	9.40	95.00	43.00	4.04	41.00	....	63.0	.....	.....
GROUP III	32	4,000	21.3	300	75	33	50	58.0	19.3	18.2	19.0	150	11.25	100.00	35.20	7.50	66.70	6.2	62.5	25.00	8,400
	33	4,000	19.0	300	75	33	62	41.7	13.9	18.9	19.0	250	18.75	101.00	39.80	7.57	40.40	8.3	86.6	5.43	8,736
	34	5,000	14.7	210	42	21	...	71.7	34.2	....	....	524	22.00	153.80	44.00	6.46	29.40	5.1	40.0	17.60	8,760
	35	5,000	14.6	365	73	46	76	30.8	8.5	24.0	24.0	167	12.20	64.60	32.30	4.72	38.70	8.7	58.1	16.15	8,760
	36	5,000	17.2	510	102	32	64	110.0	21.6	31.4	31.4	372	38.00	84.00	50.00	8.57	22.50	4.4	56.2	9.88	8,760
	37	5,450	23.1	200	37	40	79	73.8	36.9	44.1	44.6	....	.....	169.50	27.00	6.22	.....	5.3	55.6	.....	8,670
	38	7,700	15.0	550	71	24	44	128 0	23.3	25.0	25.0	452	19.20	55.80	26.60	3.99	20.70	2.7	73.0	5.61	8,760
	39	7,800	14.0	500	64	33	83	82.2	16.4	23.4	23.4	200	12.80	120.00	55.00	7.70	60.00	8.3	100.0	0.00	8,760
	Average 1915.	5,494	17.4	367	67	33	65	74.5	21.8	26.4	26.6	302	19.17	106.09	38.74	6.59	39.77	6.1	66.5	11.38	8,701
	Average 1914.	5,680	14.5	489	87	47	45	67.4	14.5	23.2	23.5	261	21.30	80.10	41.50	5.94	34.10	7.2	66.1	11.59	8,660
	Average 1913.	4,550	12.9	277	61	33	66	36.7	21.4	....	33.0	222	12.67	116.16	52.78	7.06	61.76	7.7	63.4	25.81	7,379
	Average 1911.	4,580	11.5	239	53	33	74	42.1	18.0	....	26.7	248	12.30	88.50	38.75	4.46	38.25	6.8	67.1	11.95	7,720
	Average 1909.	5,670	10.0	285	51	37	50	.....	....	....	....	202	10.00	85.00	42.00	4.40	49.00	....	56.0	.....	.....

COMMERCIAL STATIONS (Continued).

	Station Number	Population of District	Number Consumers per 100 Population	Station Rating, Kw.	Station Rating per Capita, Watts	Station Rating per Employee, Kw.	Ratio, Station Rating to Connected Load, per cent	Average Load During Operation, Kw.	Ratio of Average Load to Station Rating, per cent	Annual Load Factor, per cent	Operating Load Factor, per cent	Investment per Kilowatt of Rating	Investment per Capita	Gross Income per Kilowatt of Rating	Gross Income per Consumer	Gross Income per Capita	Gross Income per $100 Invested	Gross Income per Kw-hr. Made, Cents	Ratio, Expense to Gross Income, per cent	Earnings from Operation per $100 Invested, Interest and Depreciation not Deducted	Total Hours of Operation per Year
	Factor No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
GROUP IV	40	10,000	7.3	900	90	112	76	92.0	10.2	27.9	27.9	183	16.50	41.60	51.00	3.74	22.70	4.6	71.5	6.45	8,760
	41	10,000	15.0	950	95	63	...	137.0	14.4	25.8	25.8	380	36.10	82.60	52.20	7.84	21.70	6.5	36.8	13.73	8,760
	42	11,400	16.3	1100	97	30	58	192.0	17.5	33.7	33.7	454	44.00	75.00	44.30	7.23	16.50	4.9	85.3	2.38	8.760
	43	11,500	15.7	2000	174	74	133	228.5	11.4	41.5	41.5	357	62.10	41.60	46.30	7.24	11.70	4.2	49.4	5.91	8,760
	44	12,000	13.3	750	63	29	...	.....	.....	.....	.....	608	38.10	90.70	42.50	5.66	14.90	....	53.0	7.00	8,760
	45	16,200	7.6	1600	99	100	106	290.0	18.1	26.7	26.7	188	18.52	55.00	70.90	5.43	29.30	3.5	60.3	11.67	8,760
	Average 1915.	11,850	12.5	1217	103	68	93	187.9	14.3	31.1	31.1	362	30.89	64.42	51.20	6.19	19.47	4.7	59.4	7.86	8.760
	Average 1914.	12,690	12.5	1225	103	53	86	171.6	15.0	32.9	32.9	423	44.10	68.20	45.18	5.96	15.62	4.6	54.6	7.32	8,760
	Average 1913.	17,060	7.2	1080	63	119	56	215.0	20.0	....	29.7	579	27.47	82.55	64.07	4.27	60.55	4.9	50.3	16.13	8,760
	Average 1911.	14,500	8.4	1206	92	128	70	141.0	14.1	....	22.6	277	18.70	65.70	52.95	4.27	24.10	5.5	54.7	10.71	8,760
	Average 1909.	15,500	5.0	775	50	71	67	.....	....	....	22.0	139	8.00	60.00	60.00	3.20	54.00	....	71.0	.....	.....
GROUP V	46	25,000	10.4	1000	40	33	19	527.5	52.7	45.5	45.5	311	12.45	132.00	50.60	5.28	42.40	2.9	45.9	23.00	8,760
	47	26,000	10.0	3050	118	160	102	405.5	13.3	19.3	19.3	163	19.15	42.40	49.70	4.97	26.00	3.6	40.5	15.50	8,760
	48	36,000	12.0	4200	117	81	46	685.0	16.3	31.1	31.1	282	33.90	55.30	53.70	6.46	19.60	3.9	47.8	10.25	8,760
	49	40,000	10.1	9500	238	158	154	987.5	10.4	29.0	29.0	126	30.00	25.00	58.50	5.94	19.80	2.7	40.0	11.89	8,760
	50	45,000	13.7	3400	76	...	82	899.3	26.5	37.0	37.0	492	37.20	120.60	66.70	9.12	24.50	5.2	49.8	12.30	8,760
	51	119,000	8.9	8500	71	46	42	2030.4	23.9	34.4	34.4	412	29.40	79.10	63.60	5.64	19.20	3.8	46.1	10.35	8,760
	Average 1915.	48,500	10.8	4942	110	96	74	922.5	23.8	32.7	32.7	298	27.02	75.73	57.13	6.23	25.25	3.7	45.0	13.88	8,760
	Average 1914.	46,830	9.5	4130	91	87	47	748.3	19.6	32.3	32.3	261	22.40	72.50	69.20	5.80	28.20	3.9	47.1	14.78	8,760
	Average 1913.	44,500	7.5	3120	64	209	56	593.0	24.4	....	24.3	326	19.91	81.35	71.10	4.52	28.22	4.1	50.6	13.03	8,760
	Average 1911.	55,600	6.2	2890	51	81	43	653.0	22.7	....	31.5	541	27.20	80.50	68.90	4.17	15.27	4.1	48.9	8.26	8,750
	Average 1909.	53,000	5.0	2110	46	262	42	.....	....	....	24.0	195	9.00	88.00	79.00	3.50	42.00	....	51.0	.....	.....
	Grand Av. 1915	8,920	17.1	856	82	46	74	177.9	17.7	24.5	26.9	242	18.52	86.10	38.70	6.19	40.99	7.2	66.7	11.73	7,998
	Grand Av. 1914	9,470	14.6	819	77	45	56	152.0	18.3	24.9	29.5	251	18.45	87.30	41.00	5.78	37.25	7.6	67.8	11.60	7,610
	Grand Av. 1913	11,400	12.5	778	61	71	35	155.0	23.2	....	29.3	255	14.23	93.50	49.90	5.74	50.60	8.2	63.6	19.00	6,950
	Grand Av. 1911	14,920	10.6	576	64	51	72	117.0	22.0	....	30.1	252	13.85	82.10	47.60	4.36	36.80	7.8	67.5	9.82	6,710
	Grand Av. 1909	9,411	9.0	401	44	63	56	.....	....	....	32.0	220	9.60	89.50	46.00	3.93	41.60	....	64.0	.....	.....

MUNICIPAL STATIONS

	52	600	16.7	22	37	22	45	10.2	45.3	17.8	56.6	356	13.33	80.00	18.00	3.00	22.50	6.4	61.2	8.75	2,750
	53	800	11.2	60	75	60	...	5.8	9,7	....	....	200	15.00	43.30	28.90	3.25	21.70	10.2	75.0	5.38	4,340
	54	900	19.1	70	78	35	...	.....	....	....	....	221	17.22	60.00	24.40	4.67	27.10	....	93.6	1.74	7,202
	55	1,100	14 5	95	86	32	127	8.2	8.6	15.9	19.5	189	16.36	53.40	31.70	4.60	28.10	8.7	65.7	9.67	7,116
	56	1,800	15.3	210	117	52	...	25.3	12.0	31.2	31.6	95	11.10	58.40	44.60	6.82	61.40	5.6	88.3	7.21	8,645
	57	2.000	20.2	135	67	22	...	.....	....	....	....	237	16.00	108.00	36.00	7.30	45.60	....	70.7	13.38	8,670
	58	2,060	29 6	160	78	40	84	14.6	9.1	13.7	14.0	156	12.13	78.10	20.50	6.07	50.00	10.0	62.4	18.80	8,560
	59	2.500	12.0	300	120	75	250	6.9	2.3	7.7	7.7	73	8.80	34.50	34.50	4.14	47.10	17.1	92.8	3.42	8,760
	60	2,500	23.2	150	60	37	...	36.1	24.1	24.1	24.1	279	16.72	132.50	34.30	7.95	47.60	6.3	48.5	24.50	8,760
	61	3,000	17.7	260	87	65	...	.....	.....	.....	.....	115	10.00	53.80	26.40	4.67	46.70	....	71.4	13.33	8,360
	62	3,900	20.2	350	90	50	88	41.8	11.9	24.3	25.0	100	9.00	52.90	23.50	4.74	52.80	5.2	77.2	12.15	8,500
	63	4,500	21.1	500	111	83	...	90.3	18.1	26.0	26.0	150	16.67	71.40	37.60	7.93	47.60	4.5	55.2	21.30	8,759
	64	7,000	17.0	500	71	55	20	84.5	16.9	39.3	39.3	173	12.36	72.00	30.20	5.14	41.60	4.9	39.4	25.20	8,760
	Average 1915.	2,513	18.3	216	83	48	102	32.4	15.8	22.2	27.1	180	13.44	69.10	30.05	5.40	41.50	7.9	69.3	12.68	7,629
	Average 1914.	2,640	16.0	177	65	36	86	33.7	21.4	21.8	29.6	219	12.37	97.11	31.45	5.13	43.53	8.5	71.1	12.16	6,590

with few exceptions these could not have been secured in any other way. Mr. Hughes reported that while the tendency was for flat-rate customers to change to meter service, only four customers have changed from meter to flat rate. He commented briefly on the general advantages to the company of serving this class of consumer, and called attention to the advertising value of these patrons in spreading the gospel of electric light.

Edward Soukup, of Cedar Rapids, in the discussion reported that a flat-rate campaign had been conducted some time ago, which resulted in securing 100 customers. With the exception of 35, these have all changed to meter rates, and no efforts have been made to increase the number of flat-rate customers. The charge for flat-rate service is one cent per watt, with a minimum installation of 100 watts.

A. E. Loeb, of Chicago, commented on the experiences of companies outside of the state in securing small-customer business by means of controlled flat rates. Pittsburgh, Pa., Scranton, Pa., and Hartford, Conn., were mentioned as excellent examples.

Austin Burt, of Waterloo, thought the controlled flat rate an excellent means for fighting gas competition in the small residences. F. A. Warfield, of Peoria, also commented on the Hartford experience with flat-rate controllers, and pointed out that the income per kilowatt-hour has been shown to be 0.5 cent more than the revenue from the meter service.

Following this discussion a paper entitled "Power Development Methods for Iowa Central Stations" was presented by Edward Soukup, new business manager of the Iowa Railway and Light Company, Cedar Rapids. An abstract of this paper appears elsewhere in this issue.

Wednesday Afternoon Session.

At the afternoon session a paper entitled "Maximum Demand Meters" was presented by J. V. Montgomery, of the Mississippi River Power Company. This paper describes the various types of recording and graphic meters at present on the market, and calls attention to the requirements for such instruments. The type of meter to be used depends upon the character of the service. Curve-drawing instruments are used extensively by the Mississippi River Power Company and the Keokuk Electric Company, and these permit of compiling valuable records and data. The maximum-demand meters manufactured by the Fort Wayne Electric Works, were described in detail.

A paper was then presented by Prof. Arthur H. Ford, of Iowa City, entitled "The Financial Side of Electric Power Transactions." This paper deals with several hypothetical problems involving transmission line costs, and service costs, indicating that the question of power transmission can have no general solution, but each case must be considered by itself. The supply of energy to a small community, at a considerable distance from the power station, requires rates that are usually considered to be very high, if it is to be a profitable venture. The low demand and energy cost of the modern steam-turbine station make possible the construction of new stations having capacities of less than 500 kilowatts inadvisable, if the communities served are within a reasonable distance of a large, efficient power station.

Professor Ford presented data on an investigation made of the rates charged by some 30 Iowa power transmission companies. He reported a great variation in the rates charged for service of essentially the same nature, and an apparent lack of data as to the cost of rendering the service. In determining the cost of supplying a given service and the necessary return, from that service, Professor Ford assumed the following unit costs, based on data collected during his investigation:

Customer cost, $6.00 per annum.

Demand cost of 100-kilowatt station, per kilowatt, $35 per annum.

Demand cost of 500-kilowatt station, per kilowatt, $30 per annum.

Demand cost of 5,000-kilowatt station, per kilowatt, $20 per annum.

Cost of line, $500 to $750 per mile.

Cost of transformers and substation, $40 per kilowatt transmitted at peak load.

Demand cost of transformers, 14 per cent of installation cost, $56 per kilowatte per annum.

Demand cost of line, $70 to $105 per mile per annum.

Energy cost of switchboard, 3.5 cents per kilowatt-hour for 100-kilowatt plant, 2 cents per kilowatt-hour for 500-kilowatt plant, one cent per kilowatt-hour for 5,000-kilowatt plant.

Energy losses in line, one per cent.

Energy losses in distribution system, one per cent.

This paper was discussed briefly by Messrs. Blackwell, Lee, Anderson and Abbott. The line costs mentioned in the paper, namely, $500 to $750 per mile, were considered too low, the concensus of opinion being that a good transmission line would cost on an average of $1,000 per mile.

The report of the Committee on Facts and Factors was then presented by Austin Burt, of Waterloo, chairman. This report, which appears in tabulated form herewith, was compiled with the assistance of F. A. Fish and H. W. Wagner, of the Iowa Engineering Experiment Station, at Ames. It was reported by Mr. Burt that records not published in the report indicate an average cost per kilowatt-hour made of 7.4 cents for stations in Group 1, 5.7 cents for stations in Group 2, 4.1 cents for stations in Group 3, 2.8 cents for stations in Group 4, 1.7 cents for stations in Group 5, 5.5 cents for municipal plants.

Thursday Morning Session.

At the session on Thursday morning an illustrated paper was presented by H. W. Young, of Chicago, entitled "Out-Door Substation Construction." This paper comments on the economy and efficiency of outdoor type substations, and describes in detail the various equipment and self-contained units manufactured by the Delta Star Electric Company, of Chicago.

A paper was then presented by E. B. Pollister, of Minneapolis, entitled "The Diesel Engine in Central-Station Service." This paper contained a history of the development of oil engines with explanations of the principle of operation of the present types. Reference was made to several installations where great economy is being obtained, notably at Robinson, Ill., and Sherman, Tex. Stereopticon views were presented, showing the design of the Diesel engines and installations of same.

The session concluded with a moving picture exhibition of "Safety First" measures, as used by the National Electric Light Association, with lantern slides showing various protective equipment and appliances.

Election of Officers.

The concluding session of the convention was held on board the Steamer *G. W. Hill* en route to Burlington. Reports of standing committees were presented, these including Auditing Committee, Resolutions Committee and Nominating Committee reports.

Following this the election of officers took place, which resulted as follows:

President, E. M. Walker, of Dubuque.

Vice-president, Thomas Ferris, of Osage.

Secretary-treasurer, W. H. Thomson, Jr., of Des Moines.

Board of directors, H. C. Blackwell, of Davenport; Austin Burt, of Waterloo; M. C. Kellogg, of Keokuk, and Thomas Crawford of Clinton.

The meeting place for the annual convention next year was selected as Ames, Iowa.

Entertainment.

Elaborate arrangements were made for the entertainment of the delegates and guests attending the convention, and many took opportunity to inspect the hydroelectric plant of the Mississippi River Power Company. On Tuesday evening a banquet was held in the Masonic Temple during which an illustrated lecture was delivered by Dr. G. Walter Barr, of Des Moines, on the Keokuk dam development.

On Wednesday evening a buffet supper and smoker was held in the quarters of the Elks' Club, and following this there was a rejuvenation of the Jovian Order. The degree team was composed of L. H. Pyles, George C. Richards, H. A. Turner, George W. Hill, R. H. Blondford, F. McGinnis, C. Woods, R. D. Hightshoe and Leo Bridger. The arrangements were in charge of M. Golden and William Gueder, Charles Abell and Ray King. There were 13 candidates initiated.

On Thursday afternoon there was a delightful cruise on the Mississippi River to Burlington and return, embarking at 2 p. m.

Philadelphia Company Section to Visit Valley Forge.

The Philadelphia Company Section of the National Electric Light Association has chartered a special train to take its members and their families to Valley Forge and Betzwood on May 1. At Betzwood are the studios where the Lubin motion-picture films are made, and this plant will be inspected. The Engineering Branch of the Section has arranged this visit, William Kerford being in charge.

AMERICAN ELECTROCHEMICAL SOCIETY.

Annual Meeting Held at Atlantic City.

The twenty-seventh general meeting of the American Electrochemical Society was held at Atlantic City, N. J., and Philadelphia, Pa., April 22, 23 and 24, 1915. President F. A. Lidbury called the meeting to order on Thursday afternoon and delivered his presidential address.

The president's address dealt with the relations of the society, first pointing out the developments of these relations with its growth. It advocated participation by members and other engineers in governmental activities by placing their expert knowledge at the service of legislators and other officials. The society is a very representative one, including in its numbers a large variety of elements, and there are many subjects upon which it should take a pronounced position, such as legislation concerning water power. Patent legislation is another activity requiring attention. Co-operation with government bureaus was advocated. The members of the society should bring matters coming under their notice to the Board of Directors and committees should be appointed to actively follow up such subjects. Co-operation with other societies should be sought after.

The report of the secretary showed that the present membership of the society is 1,420. The treasurer's report gave the receipts of the year as $10,178, expenses $9,800.

The following elections were announced:

President, Lawrence Addicks.

Vice-presidents: L. E. Saunders, J. A. Mathews and L. Kahlenberg.

Managers: L. D. Vorce, Acheson Smith and W. H. Walker.

Treasurer: P. G. Salom.

Secretary: Joseph W. Richards.

The first paper presented was on "Fibrox," by E. Weintraub.

Fibrox is the name given by the author to a fibrous material composed of silicon oxycarbide. The name is to suggest the remarkable structure of the material, which is soft, resilient and fibrous. Its apparent density is below 0.003, while its real density is nearly 2, so that its volume is over 99 per cent air. It is the best heat-insulating substance known, but a good electrical conductor. The author displayed samples.

This paper was discussed by F. J. Tone, Walter Arthur, H. A. Hitchcock, E. F. Northrup, H. S. Taylor, Carl Hering, L. E. Saunders, W. R. Mott, F. C. Frary and others.

Papers on "The Thermal Conductivity of Refractories," by Boyd Dudley, Jr., and "The Temperature of Reaction between Acheson Graphite and Magnesia," by O. L. Kowalke and D. S. Grenfell, were then presented and very fully discussed. The former reported measurements on heat conduction. The latter found a reaction temperature of 2,030 degrees centigrade.

At the session on Friday morning the papers on "Neutralization of Absorbed Ions," and "The Coagulation of Albumin by Electrolytes," by W. D. Bancroft, were presented by W. R. Whitney. They were followed by the paper on "Thermo Electromotive Force of Certain Iron Alloys," by T. E. Fuller. This paper gave the values found for alloys of iron with nickel, cobalt, chromium, and manganese.

In the discussion of this paper, C. G. Fink asked if the author had noticed any difference in the electromotive force due to varying quantities of silicon and carbon, and how these ingredients affect the electromotive force.

W. R. Mott said he noticed that the carbon varied from 0.06 to 0.25 per cent, and he asked as to the probable effect of the variation.

In closing the discussion, Mr. Fuller stated that he believed that carbon had a decided effect, but he had no data as to silicon.

A paper on "Depolarization in Le Clanche Cells," by M. deKay Thompson and E. C. Crocker, was read by A. T. Hinckley.

Depolarization in Le Clanche Cells.

In the Le Clanche cell the positive electrode consists of carbon in contact with manganese dioxide. The dioxide acts as the depolarizer, but does not depolarize completely, as shown by the gradual decrease in current and voltage on closed circuits. In various forms these cells are used extensively at the present time, especially as dry cells. About 50,000,000 a year are manufactured in the United States. The authors have made a study of comparative efficiency of depolarizing mixtures of carbon and manganese dioxide when the sizes of the particles and the relative amounts of substances are varied. They find that the carbon and pyrolusite particles should have the same size, and this should be such as to allow the particles to pass through openings 0.25 centimeter square and not to pass through openings 0.02 centimeter square. The purity of the pyrolusite affects the depolarization materially. The mixture of carbon and pyrolusite should contain 55 to 60 per cent pyrolusite. Polarization by hydrogen is completely prevented by the dioxide; the remaining polarization is that due to ammonia. This may be largely overcome by the addition of zinc chloride to the solution.

In the discussion of this paper, in a written communication, N. K. Chaney brought up the question whether the term polarization should be restricted to changes supposed to occur in or on the surface of electrodes, or whether concentration differences and other changes arising in the character of the electrolyte are also understood as included in the use of the term. The existence of hydrogen polarization of the manganese electrode is denied upon the basis of results obtained with a current density of 0.05 ampere per square centimeter upon a solid manganese electrode. It would be of interest to have a further description of this manganese, as the standard Caucasian manganese has much too high resistance to permit currents of this density to pass, and he stated that he had been unable to duplicate this experiment with any material in his possession.

C. F. Burgess contributed a written discussion in which he said that it was a peculiar fact that one type of primary cell had a great deal of attention in scientific laboratories, while another type of far greater importance had been practically neglected. There is an extensive literature relating to standard cells, and some notable work has been done in the development of electrochemical standards of electromotive force. While hundreds of thousands of dry cells are used to one standard cell, and while they are playing an important part in every-day life, there is meager literature relating to the scientific problems of dry-cell construction. The authors of the paper had taken an important step towards remedying this condition. There are various problems which the manufacturers of dry cells do not yet understand. One of the features of the construction which has not been generally understood is the necessity of employing zinc chloride as a constituent of the electrolyte. He referred to the conclusion given in the paper that carbon and pyrolusite particles should be of the same size and not finer than 0.02 centimeter. While this conclusion might be drawn from the particular method of construction used, it may not apply under other methods of construction. The high-capacity flashlight cells on the market use finer materials than are specified and apparently with great advantage. One of the difficulties of conducting comparative tests he considered to be the large number of variables which must be considered. The pressure of tamping is a most important factor. The amount of moisture is another one. Small amounts of certain impurities may dictate one method of construction with one grade of material and another method with another grade, to develop the best results.

J. W. Richards stated that pyrolusite is one of the most variable materials in composition, and had many varying elements, and the conclusions drawn on one commercial material are likely to be entirely false for another.

F. C. Frary suggested that the rate of polarization action of the manganese dioxide is due to its solubility in the

electrolyte more than any other thing, and the probable effect of the zinc chloride and the ammonia is due to the rate of solution of the manganese dioxide and its concentration around the solid manganese dioxide.

W. R. Whitney expressed the opinion that it was, in a sense, unfortunate that a professor of chemistry should find it necessary to do work of the kind contained in the paper. The reason for this is, he thought, that the student desires to work at something practical, and will not take up these studies. On the other hand, there is not enough encouragement in this country for men in the position of the authors of the paper to do pure chemical research. He believed that the manufacturing companies should co-operate more generally in work of this kind and should give the profession generally the benefit of the results of such studies as they might make on this and kindred subjects.

H. A. Hitchcock expressed the opinion that students should be encouraged to make these investigations and that facilities should be furnished them for that purpose.

W. S. Franklin believed that the time is coming when the industries interested in work of this kind must more generally perform these researches, and he believed that it would be a wise policy on their part to make public the results of such work as they did in this direction.

Lawrence Addicks then read printed contributions, embodying discussions at previous meetings of the society, on the subject, "Some Problems in Copper Leaching."

At the Friday afternoon session the first paper presented was on "The Formation of Magnesium Suboxide in the Electrolytic Preparation of Magnesium," by F. C. Frary and H. C. Berman.

The authors concluded that magnesium suboxide is formed during the electrolysis of magnesium-potassium chloride if magnesium oxide is present. A high temperature facilitates its formation.

This paper was discussed by T. W. Bennett, J. W. Richards, H. S. Taylor and L. D. Vorce.

This was followed by the paper on "Calorizing Metals," by W. E. Ruder, which was discussed by Lawrence Addicks, F. A. J. FitzGerald, William R. Mott and L. D. Vorce.

Calorizing consists in producing a rich aluminum alloy upon the surface of the metal to be protected from an oxidizing temperature. Experiments were described in applying this method to iron, copper and nickel with success. With cast iron it was not so successful. Calorizing protects the metals indefinitely at temperatures below 1,000 degrees centigrade from oxidation.

The papers on "Fixation of Atmospheric Nitrogen," by L. L. Summers, "The Cyanamide Process," by F. S. Washburn, and "Commercial Nitrogen Fixation," by S. Peacock, were then presented.

The first two of these had been presented at a meeting in New York City and were abstracted in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, March 20, page 536. Mr. Peacock presented a brief summary of the economic situation in the United States regarding the production of nitrogen compounds. No method for fixing nitrogen has as yet been proposed which can produce combined nitrogen as cheaply as coke-by-product ammonia. Ammonium nitrate or ammonium phosphate is more economical than ammonium sulphate, calcium phosphate or sodium nitrate, as the latter carry constituents useless or worse than useless for industrial purposes. A successful nitrogen-fixation process must give as an end-product potassium nitrate, ammonium nitrate or primary ammonium phosphate, and the factory cost must not materially exceed five cents per pound of combined nitrogen figured as ammonia. A synthetic ammonia process, such as that of Haber, can never become commercially important.

In connection with the presentation of his paper, Mr. Summers said that he thought Mr. Peacock had been too modest in the presentation of his work and should have gone into it more thoroughly; that he did not accept the unqualified statements in regard to the success of cyanamide that Mr. Washburn put forth, because he had been very successful. He did not think that all of the engineers interested in that process accepted it as the last word in nitrogen fixation by any means. He thought that the partial pressure, the vapor tension, mentioned in connection with the discussion of the paper on calorizing, entered into the subject in a most remarkable way. The Serpek process obtained in this country a range of temperature from 1,700 to 1,900 degress centrigrade, and no provision has been made for the partial pressure. That would affect the temperature of this reaction over a range of several hundred degrees. At a partial pressure of about one-half atmosphere, the temperatures in these reactions are lowered very materially, so that they could come within a range of 1,200 to 1,500 degrees, and make it possible to use direct oxidation. In his opinion the direct-oxidation methods gave the most promising field for research in this country at the present time. As to the price of materials, there is competition, first with the sodium nitrate of Chile, and second, with the by-product of the coke oven and the gas retort, and both the latter are undergoing radical changes in this country. The gas retort has been superseded by the water-gas process and enriching with oil. On account of the ever increasing price of oil, due to the great demand for gasoline, the crude oils and the refuse oils are not going to be available at the same price for gas enrichment, which meant that the gas retort will be used more and more, and there will be a greater quantity of ammonia as a by-product, and the coke oven will come into operation more and more, and as for this by-product, there is only the cost of recovering it involved. As there is also a large amount of waste heat, the chances are that at the coke oven many of the nitrogen processes will be operated for the commercial manufacture of fertilizers, so there are many fields which have not been touched on, and therefore it did not seem to him that the cyanamide process was the last word in nitrogen fixation.

C. W. Bennett, in a communicated discussion with reference to the paper by L. L. Summers, said that it seemed to him the situation was such that the by-product ammonia will fix the cost of nitrogen-fixation processes. No process at the present time measures up to that figure, and therefore it would appear that no process in operation is commercial. He believed that this statement was borne out by the facts presented in the papers on nitrogen fixation. With reference to the paper by F. S. Washburn, Mr. Bennett said that no one denied the preparation of cyanamide is the cheapest working process in the fixation of nitrogen. Nitrogen, however, from cyanamide, is not as cheap as nitrogen from other sources. It must be admitted that by-product ammonia can be placed on the market as ammonium sulphate at a profit for very much less, approximately one-fourth the selling price of cyanamide. The industry is increasing steadily in this country and in others, and it will need development of only a few other by-products to enormously increase the output of by-product ammonia. He believed that no process in operation at the present time for the fixation of nitrogen could hope to compete with by-product ammonia. The final user does not care whether his ammonia comes from the distillation of coal or from atmospheric nitrogen.

W. R. Mott stated that the first principle of efficient operation is to very rapidly cool highly heated air. This meant using small arc cross-sections. This can also be secured by using rapidly moving air currents, rapidly moving arcs, and by using sprays of cold material. The second principle is to

use the heated gases leaving the arc to heat the coldest gases entering the arc. This is most important and will probably lead to great improvement in the efficient commercial manufacture of nitric acid from the air.

Joseph W. Richards said that he understood that the Cyanamide Company was expecting very radical changes to be made in the next five or ten years, and was prepared, if necessary, to stop the whole plant inside of 20 years, as possibly there would be no cyanamide process at that time.

J. E. Johnson, Jr., said that the remarks in regard to the development of the by-product coke oven were true, that if any one were to draw a curve of the rate at which by-product coke was replacing other forms of coke, the curve would run with a very rapidly rising sweep. The probabilities are from a figure of 5 per cent in volume of by-product a few years ago the total will be 50 per cent in a short time. The by-product process has just come into its own in this country. The process is a success, even if no allowance is made for the value of the ammonia. In order to bring the production of farm products in this country up to the yield secured in foreign countries, it will be necessary to use very large quantities of fertilizer, and the use of fertilizer will increase faster than the production of ammonia from by-product ovens. As to the question of the production of nitric acid, he had seen a statement that the theoretical efficiency of the process could be raised to something like 10 or 15 times what it now is by making the concentration of oxygen approximately that of the gas produced by the combustion; in other words, doing away with the excess of nitrogen. He stated that he thought it remarkable that nothing had been done to increase the efficiency of the arc in some of the nitric-acid processes, but understood the reason was the large power cost, rather low concentration, and the rather large apparatus necessary.

L. L. Summers remarked in relation to nitrogen and oxygen that the maximum effect would be obtained when there was 50 per cent nitrogen and 50 per cent oxygen, so that the possible increase was about 20 per cent, and yet probably the dissociation of the products, due to the temperature at which the process is carried on, does not justify the expense of preparing an atmosphere higher in oxygen content.

Referring to the natural production of phosphate fertilizers, he mentioned that there were many vast deposits of the low-grade phosphate rock in the United States running from 10 to 20 per cent, that would be of inestimable value on farms close to where these rocks are situated. They could readily be crushed and fertilizers made from them.

Leo Baekeland said that he was pretty well acquainted with the utilization of fertilizers in Belgium, where considerably more nitrogen fertilizer is used than in Germany, the yields of produce per acre in Flanders being decidedly higher than the yield per acre of any other country in Europe. He referred to the fact that in many cases it was considered more expensive to buy fertilizers than to have a low yield of produce, and in this country that condition is aggravated by the number of middlemen and the distance and expense of transportation. He mentioned the rather large deposits of peat in the United States from which an immense supply of ammonia was available.

W. R. Whitney believed the matter under discussion was of the utmost importance. He said that the best phosphate in the United States was being shipped abroad. He asked the question, if all of the coke was by-product coke and all of the nitrogen in the coke should become available as ammonium sulphate, what part of it would make pure nitrogen for fertilizer use?

J. E. Johnson, Jr., replied that in times of normal business in this country there are somewhere around 30,000,000 tons of coke produced annually, with about 18 pounds of ammonium sulphate and 10 pounds of ammonia per ton, which would make about 150,000 tons of ammonia. The percentage of the by-product is about 25. It has gone from 1 or 2 to 20 or 25 per cent.

The sessions on Saturday were held at the University of Pennsylvania in Philadelphia. At the morning session, which was a joint session with the Illuminating Engineering Society, a paper on "Efficiency in Light Production," by H. E. Ives, was presented.

An Illuminating Engineer's Conception of an Ideal Light.

The distinctive function of the illuminating engineer is to utilize light sources in the most efficient manner. The paper discussed the requirements of light sources for the best utilization, such as low intrinsic brilliancy, quality of color, etc. The more common light sources are of high intensity and small area, thus requiring modification of their characteristics before use. It is consequently quite possible to find sources of light which will be much more suitable for the purposes of the illuminating engineer and at the same time give higher efficiencies than those attained. The author suggested, for example, window shades covered with a luminous paint of low brilliancy. A source with daylight quality having a much lower efficiency than the common illuminants would find a large field of application. It was pointed out that the present efficiency of light production is very low, the most efficient sources not utilizing more than seven per cent of the energy supplied. The three common methods of producing light were then considered. One is by radiation due merely to high temperature. Not much better can be expected in this direction. The second is the use of selective radiation from materials at high temperatures. The third is the low-temperature radiation, which includes phosphorescence, organic light production, etc. These forms are characterized by low intrinsic brilliancy. They have received little consideration for practical purposes, yet the most efficient light source known, the firefly, is of this type.

Lawrence Addicks in opening the discussion said unfortunately the illuminating engineer had to compete with a standard of light established by nature, by which he had not only been governed, but perhaps prejudiced. The illuminating engineer having found that a more or less monochromatic light could be generated, endeavored to persuade users of light that their preference to look pink rather than green was, after all, a matter of taste. In recent years, however, the illuminating engineer had returned to more rational standards, and realizing that the sun is simply a ball of fire, hung high enough up to be out of the way, now imitates this source, and being unable to hang it high enough turns it upside down against a screen to shield it.

The paper was discussed by J. W. Richards, Carl Hering, and Roy Kegerreis.

A paper on "Chemistry in the Development and Operation of Flaming Arc Carbons," by W. C. Moore, was read by W. R. Mott.

Chemistry in the Development and Operation of Flaming-Arc Carbons.

The author sketched the historic development of the flaming arc and described the method of manufacture of electrodes. Desirable operating characteristics were then considered. Reliability is of first importance. This involves constancy of distribution of light flux and of color and ability to start with cold points after the carbons have been in use. The part that chemistry has had in increasing the reliability was pointed out, especially with reference to spotty effects, the formation of slag, etc. Figures were given for the efficiency of various types of flaming arcs and for the life of electrodes. The selection of the proper materials for the electrode, for the flaming material of the core and the proper mixture of the core material was next considered. The chemical control of the impurities present in the raw materials is of great importance. There are three possible sources of light in the flaming arc: Electro-luminescence, thermo-luminescence and chemi-luminescence. Their relative importance is unknown. There are two types of arcs: Those in which the outer sheath seems to be intensely luminous and those in which the core of the arc seems to be more luminous. The latter type gives light of shorter wave-lengths. Progress made in the art of flaming arcs has been due to the co-operation of the

chemist, physicist and the electrical engineer.

In the discussion of this paper W. R. Mott said that the flame arc was a very complex problem, but there was no known limit to its efficiency or future development. The incandescent lamp seemed to have reached its limit in the use of tungsten at a few hundred degrees below its melting point. Referring to inclined-trim carbons, he stated that he had made, by suitable additions, carbons with 70 per cent greater candlepower than possible by calcium fluoride alone. In the mercury arc, the electro-luminescence is all important, since chemical-luminescence is precluded because of the known atomic condition of the mercury vapor and absence of other reactive elements.

W. A. Darrah, in a written communication, stated that his experience with flame arcs indicated that the troubles which have been occasionally charged against them may be appreciably reduced, or even eliminated, by proper attention on the part of the operating man; thus, if the lamp user will take care that the globes seat tightly, that there is no way for air or moisture to enter the globe, and will clean the lamps properly at the time they are trimmed, the performance will be much improved. The few cases in which operating difficulties had been reported appeared to be traceable to causes of this nature. In actual practice, there appeared to be a very slight difference in the life of carbons when operated on direct-current circuits or alternating-current circuits, provided the total wattage is approximately the same. There was, however, a tendency in the yellow carbons to have a somewhat shorter life than white carbons, although this, of course, varies with the different types of carbon.

G. S. Barrows said if it is to be possible with arc lamps, with the proper flame carbon, to get a proper colored light by a change in the ingredients of the carbon, or proper mixtures in the carbon, it will be a tremendous step in advance.

Lawrence Addicks suggested that when the paper is printed the rare-earth compound and the quantity used be given, as an appendix to the paper. He pointed out that if any one cared to analyze the carbon, the contents of the carbon could be discovered, and he did not think there was any reason why the manufacturers should withhold a statement of exactly what these compounds are.

The next paper was entitled "Lighting of Electrolytic Tank Rooms," by R. E. Harrington.

Lighting of Electrolytic Tank Rooms.

Standards of artificial lighting are rapidly rising and their application to tank rooms is considered. Experience has shown that a properly lighted plant has a marked effect on quality of production and the occurrence of accidents. The particular accidents occurring in tank rooms which may thus be influenced are: Falls from narrow passageways around the tanks into the acid; injuries from moving cranes; falls in stairways and landings; burns from bad electrical connections; injuries from dangerous machinery and belting. The proper kind of lighting and location of lighting units is considered. Unshielded sources should be avoided by the use of suitable reflectors and diffusers. Porcelain-enamel reflectors are preferred and direct general illumination is generally most suitable, although localized lighting should be used where tanks are covered by hoods. Protection from acid fumes is often necessary. Porcelain sockets should always be used. With open reflectors it is often necessary to protect the lamp base and socket contacts from fumes. This can be accomplished by a gasket of asbestos fitted around the neck of the lamp and pressed against the inner side of the reflector. The gasket should be saturated with water-glass before applying. The proper size and space of lamps is discussed and where there is a crane it is suggested that units be located along the wall under the crane. Several installations were then considered in detail. Experience has shown that in many cases the cost of proper lighting with modern lamps is less than with improper lamps of the older types.

President Lidbury, in calling for discussion, said that there is no question but that the illuminating engineers are doing a great work in insisting on every opportunity for installing good lighting, to secure efficient results in industrial establishments.

Lawrence Addicks referred to the various stages of lighting of electrolytic tank rooms, beginning 15 years ago with the arc lamps, which were rather unsatisfactory. This was followed by the mercury-vapor lamp, and then the tungsten lamps were used. The conditions in tank rooms with respect to lighting have been greatly improved by better conditions of ventilation, which carried off the fumes and other materials which had previously interfered with the lighting.

C. E. Stephens referred to the great part which artificial lighting plays in many industrial establishments, where manufacturing processes are carried on for 18 or 24 hours a day. Numerous data are available, he said, which show that the cost of a good lighting system is only a fraction of one per cent of the gross wages of the employees operating under the lighting system.

G. B. Hogaboom referred to the carrying on of plating processes under the tungsten lamp. He said under such circumstances it was difficult to distinguish brass. The arc lamp in a plating room is almost a failure, and the mercury-vapor lamp gives such a peculiar tint to nearly everything in the room that it is seldom desirable to use it.

At the Saturday afternoon session, which was a joint session with the American Electroplaters' Society, E. F. Smith, provost of the University of Pennsylvania, delivered a lecture on "The Precipitation of Calcium," and his assistant, H. S. Lukens, performed certain experiments at the close of the lecture.

The paper on "Cleaning and Plating in the Same Solution," by O. P. Watts, was then read by F. C. Frary.

Cleaning and Plating in the Same Solution.

For a number of years a single bath has been used for removing grease and dirt from metals and at the same time electroplating them. This process is increasing in favor among platers. Its most frequent use is for giving to iron and steel a preliminary coating of copper before nickeling. The advantage over using two separate solutions is the saving of time and labor required to transfer the articles and the possibility of detecting failure to remove grease while the object is still in the cleaning solution. It is not so suitable for heavy deposits of metal. The author compared Lovering's combined cleaning and plating solution with various separate solutions and found it capable of doing effective cleaning on flat metal. The best conditions of use are stated. A similar attempt to deposit brass gave good results, but there is some difficulty in controlling the color of the deposit. This matter will be further investigated. Experiments upon simultaneous cleaning and nickeling of iron were unsuccessful.

This paper was discussed by C. G. Schuleuderberg, George B. Hogaboom, C. H. Proctor, S. D. Benbliel, F. C. Frary, H. S. Lukens, C. H. Chapin and J. W. Richards.

A paper on "Electrodeposition of Smooth Lead from Lead-Nitrate Solutions," by F. C. Mathers and Asa McKinney, was read by the secretary, and discussed by W. D. Bancroft, C. W. Bennett, Lawrence Addicks, C. G. Fink and C. H. Proctor. The authors succeeded in obtaining as smooth coherent lead deposit from lead-nitrate solutions as from any other lead bath.

The last paper presented at the meeting was "Electroplating with Cobalt," by H. T. Kalmus, C. H. Harper and W. L. Savell, and was read by the secretary. This paper reported a series of experiments showing the suitability of cobalt plating to replace nickel plating for many purposes. Cobalt has all the desirable qualities of nickel and in addition can be plated more rapidly and is more adherent and harder.

Written communications on the subject were received from O. P. Watts and C. W. Bennett. The paper was also discussed by W. Lash Miller, C. H. Proctor, George B. Hogaboom, W. Blum, H. S. Lukens, C. H. Chapin.

After the customary vote of thanks, the meeting adjourned.

Program for the San Francisco Convention of the National Electric Light Association.

Herewith is given the tentative program of the San Francisco convention next June. A large amount of business is presented for consideration, and most of it is of an important character. At first it was proposed to crowd the work into three days, but various reasons forbade limiting the sessions to Tuesday, Wednesday and Thursday; and the extra sessions will therefore allow the subject-matter to be treated in a more leisurely way, favorable to fuller discussion. Moreover, as the special trains do not pull out on their return trips until Saturday and Sunday, good use is thus made of some of the intervening time. Another feature of interest is the proposed shifting of the Public Policy meeting from Wednesday to Thursday evening, owing to the difficulty in securing a suitable hall for Wednesday night. Usually at the N. E. L. A. conventions for many years past there have been no sessions on Wednesday afternoon, because of the objection to holding the delegates together for sessions morning, afternoon and evening, which would make a strenuous and exhausting day. With the Public Policy meeting on Thursday evening, the afternoon recess will also fall on that day, and as there will be no baseball match this year, the afternoon will be devoted, by invitation of the Exhibition Committee, to an official visit of the convention to the electrical exhibits at the Panama-Pacific Exposition.

Tuesday, June 8, 10 a. m.

First General Session: Welcome to the City, by Mayor Rolph; Welcome to the Coast, by John A. Britton; Address of President Scott; Report of Committee on Organization of the Industry, by George Williams; Report of the Secretary, by T. C. Martin; Report of Insurance Expert, by W. H. Blood, Jr.; Report of Committee on Progress, by T. C. Martin; Report on Question Box, by S. A. Sewall; Report of Committee on Education, by J. F. Gilchrist; "Revivals," by Paul Lüpke.

Tuesday, 2:30 p. m.

First Technical Session: Report of Committee on Meters, by C. G. Durfee; Report of Committee on Electrical Apparatus, by L. L. Elden; Report of Committee on Grounding Secondaries, by Paul Spencer; "Application of the Diversity-Factor," by H. B. Gear; "Features of the Lighting of the Panama-Pacific Exposition," by W. D'A. Ryan.

Tuesday, 2:30 p. m.

First Accounting Session: Chairman's Address, by H. M. Edwards; Report of the Library Committee, by E. J. Allegaert; Report of the Question Box Committee, by E. C. Scobell; Report of the Committee on N. E. L. A. Uniform System of Accounts, by J. L. Bailey; "Some Opportunities of Public-Utility Accountants," by L. H. Reynolds, auditor, California Railroad Commission.

Tuesday, 2:30 p. m.

First Commercial Session: Chairman's Address and Report of Committee on Foreign Relations, by Douglass Burnett; Report of Commercial Section Finance Committee, by J. F. Becker; Report of Membership Committee, by J. G. Learned; Report of Publications Committee, by E. A. Edkins; Report of Sub-Committee on Salesman's Handbook, by C. J. Russell; Report of Committee on Education of Salesmen, by F. R. Jenkins; Report of Committee on Commercial Department Terminology, by M. E. Turner.

Wednesday, June 9, 10 a. m.

First Hydroelectric and Second Technical Session: Address of Chairman of Hydroelectric Committee, by M. R. Bump; Report of Committee on Hydroelectric and Transmission Progress, by T. C. Martin; Report of Committee on Prime Movers, by I. E. Moultrop; "Practice in High-Head Hydraulic Plants," by J. P. Jollyman; "Governor-Effort Analysis," by E. D. Searing; "Oil Burning," by P. M. Downing.

Wednesday, 10 a. m.

Second Commercial Session: Address, by C. C. Moore, president Panama-Pacific Exposition; Report of Power Sales Committee on Typical Power Sales Development in the West, by J. H. McDougal; Report of Committee on Merchandising and Recent Development of Electric Appliances, by R. R. Young.

Wednesday, 10 a. m.

Second Accounting Session: "Workmen's Compensation Insurance," by R. J. Sullivan, secretary, Travelers' Insurance Company; "Electric-Vehicle Cost Accounting," by W. P. Kennedy; "Standardizing the Accounts of the Pacific Gas and Electric Company," by M. H. Bridges; "Record of Property or Construction Expenditures," by P. R. Ferguson.

Wednesday, 12:30 p. m.

Brief Executive Session.

Wednesday, 2:30 p. m.

Third Commercial Session: Report of Lamp Committee, by F. W. Smith; Report of Committee on Wiring of Existing Buildings, by R. S. Hale.

Wednesday, 2:30 p. m.

Second Hydroelectric and Third Technical Session: Report of Committee on Overhead Line Construction, by Thomas Sproule; "Overhead-Line Construction on the Coast," by J. C. Martin; Report of Hydroelectric Sub-Committee on High-Tension Transmission and Construction, by R. J. McClelland; Report of Hydroelectric Sub-Committee on High-Tension Apparatus, by W. N. Ryerson; Report of Hydroelectric Sub-Committee on Main-Line Electrification of Railroads, by B. F. Wood.

Thursday, June 10, 10 a. m.

Third Accounting Session: Report of Committee on Cost Accounting, by J. H. Gulick; "Analysis of Cost by an Electricity Supply Company for Rate-Making Purposes," by A. D. Spencer and R. W. Symes; "Analytical Accounting for Central-Station Purposes," by O. B. Coldwell; Presentation and Adoption of New Accounting Section By-Laws; Report of the Nominating Committee; Installation of Section Officers.

Thursday, 10 a. m.

Fourth Commercial Session: Report of Rate Research Committee, by R. S. Hale; Report of Power Sales Bureau of the Commercial Section, by C. J. Russell; "The Commercial Application of Resistance Furnaces," by C. W. Bartlett; "A Stassano Furnace Installation at Redondo, Cal.," by W. M. McKnight; "Electric Furnace Power Loads," by F. T. Snyder; "Charges for Electric Welding Service," by C. K. Nichols.

Thursday, 10 a. m.

Fourth Technical Session: Report of Committee on Terminology, by A. S. McAllister; Report of Committee on Street Lighting, by J. W. Lieb; Report of Committee on Underground Construction, by P. Torchio; "Timber Preservation," by R. A. Griffin; Report of Committee on Accident Prevention, by M. J. Insull; "Opportunities of the Public Service Companies in General Accident Prevention," by C. B. Scott.

Thursday, 8:45 p. m.

Public Policy Meeting: Report of the Public Policy Committee, by W. W. Freeman; "Public Service Commission Relationships," by John H. Roemer.

Friday, June 11, 10 a. m.

Fifth Commercial Session: Report of Committee on Power Sales Methods; Demonstration of a Power Sale, by C. H. Stevens; Election of Section Officers.

Friday, 10 a. m.

Second General and Executive Sessions: Report of Committee on Company Sections, by F. J. Arnold; "Company Section Work," by D. C. Bruce; "The Electric Vehicle and the Central Station," by J. F. Gilchrist and A. J. Marshall; "Electrical Prosperity Week," by J. M. Wakeman; Report of Committee on Doherty and Billings Prizes for Company Section Papers, by P. Lüpke; Report of the Committee on Memorials, by T. C. Martin; Report of Committee on President's Address; Report of Committee on Resolutions; Election of Officers.

Electric Ship Propulsion.

W. L. R. Emmet, of the General Electric Company, gave an illustrated talk on this subject before the joint meeting of the Chicago Section, American Institute of Electrical Engineers, and the Electrical Section, Western Society of Engineers, at the society's rooms in Chicago on April 26. Mr. Emmet modestly reviewed his connection with the development of electric ship driving, to which he has devoted much time for the past six years or so. Although motors for ship propulsion have been used in storage-battery launches since 1893, not much attention was given to the subject until the development of the high-speed steam turbine. The great space and weight economy of this machine, together with the large range over which it works at very high efficiency, make it a very desirable prime mover for marine use. The reciprocating engine works at highest economy only in a limited range.

Steam turbines give best results at very high speeds, whereas propellers give best efficiency at moderately low speeds. Direct coupling results in neither the turbine nor propeller running at their best. Electric propulsion consists in having a high-speed turbine drive directly a generator that supplies current to the propelling motors. By means of pole-changing induction motors it is possible to run at several speeds of those units with good efficiency without greatly decreasing the turbine speed below its most efficient value. The turbines and propellers are thus run at their best speeds, giving the highest all-around efficiency, even allowing for the electrical losses which amount to about eight per cent of the power transmitted. Opponents of electric propulsion have claimed that the electrical transformation was a needless waste and that a speed-reduction gearing would accomplish the same results more economically. Two United States colliers, the sister ships *Jupiter* and *Neptune*, were equipped with electric drive and speed-reduction gearing, respectively. The *Jupiter* has been in service about two years with a remarkably good record; its steam consumption is only 11 pounds per horsepower-hour; no trouble has been experienced and no repairs needed. Maneuvering is done perfectly. This fine performance brought about a year ago the serious consideration of electric propulsion of battleships, which is the best field for electric drive.

A contract for the electrical equipment of the new United States battleship *California* has just been closed with the General Electric Company. Its turbines will run at a maximum speed of 2,200 revolutions per minute and develop at the propeller shaft 75 per cent of the energy of a perfect engine; compared with 62 per cent in the case of the liner *Lusitania*, the most powerful direct-turbine-driven vessel. The electrical losses are offset in the case of a large vessel by the improved propeller efficiency. Mr. Emmet said he could re-equip the *Lusitania* electrically and save it about $150,000 annually on its coal bill.

Electric propulsion has been held back a long time because marine men had faith in the value of reduction gearing. Such gearing is suitable for certain types of vessels, particularly low-speed ships whose power requirements do not exceed about 10,000 horsepower. The total loss in gearing and bearings probably does not exceed two per cent of the power transmitted. However, it is necessary to have a multiplicity of turbines and gear sets, if a number of operating speeds at high efficiency are desired. This greatly complicates the machinery layout, increases tremendously the weight and space taken up thereby and also the cost of the equipment. In one scheme proposed by Parsons for a vessel of about the size of the battleship *California* it was proposed to use 32 turbines, whereas in the *California* only two will be provided. The General Electric Company has now under contract turbine and gear-drive equipment of special type with laminated gears for three large freighters, these being low-speed vessels; this is a field in which electric driving is not so favorable. Electric ship propulsion is very advantageous, however, in the case of very large vessels requiring a total of 15,000 horsepower or over. It is peculiarly adapted to large battleships and cruisers that are normally run at speeds of 12 to 17 knots while cruising and should do so at the highest possible economy. In an emergency, however, as during battle, pursuit or flight, it should be possible to operate them at high speeds of over 20 knots with nearly as good efficiency.

Mr. Emmet described the equipment of the collier *Jupiter*, which has a 7,000 horsepower turbine driving a 2,000-volt generator. The entire equipment is very rugged. The induction motors used for propulsion are provided with external secondary resistance for reversing. The battleship *California* will have a tonnage of about 30,000; its two turbines will develop a maximum of 18,000 horsepower; these turbines will have over-all length of only 14 feet. The engine room will be much narrower than was at first anticipated, leaving a compartment on either side thereof which will greatly increase the safety of this essential part of the vessel. All auxiliaries in the engine room will be motor-driven, current being supplied by a separate non-condensing turbogenerator set. The maximum speed will be 22 knots. Either of the two main turbo units will operate the vessel alone up to a speed of 18 knots per hour, which will be ample for ordinary cruising. The motors of the *California* will be of the squirrel-cage induction type provided with a double rotor winding; the main winding will be located deep in the slots, whereas the winding called into play during reversing will be located near the surface of the slots. To facilitate reversal, which is the most difficult feature of electric propulsion, use will also be made of momentary high excitation. This problem has been studied out very carefully and has finally been worked out with complete success.

The discussion of Mr. Emmet's paper consisted largely of questions propounded to him. He said that the two primary sources of economy in electric drive compared to engine drive of propellers are the absolutely uniform rotative speed given to the propeller shaft throughout the revolution and the freedom from racing while the vessel is traveling in a rough sea.

Chicago Electrical Contractors and Fixture Men Indicted for Conspiracy in Restraint of Trade.

The United States Grand Jury, sitting in Chicago, on April 27, returned indictments against 18 union officials, 41 electrical and lighting fixture contractors as individuals, and 41 firms and corporations. It is understood that the indictments are the result of a 10 months' period of investigation by a special Grand Jury inquiring into several phases of alleged agreements between contractors and unions in Chicago. The Government has declared that some of these agreements are in violation of the Sherman Anti-Trust Law, and the Interstate Commerce Act. On the other hand, without exception the indicted union officials and the electrical contractors and fixture men, all of whom are conspicuous figures in business life in Chicago, and leaders in the electrical industry, emphatically state that they know of no reason why such indictment should be brought, and that the announcement of the investigation and the return of the indictments are in the nature of a complete surprise to them.

The group of indictments includes union business agents, contractors, switchboard manufacturers and fixture men, and general electrical and lighting fixture firms and corporations. One indictment charges the officials with entering into an arrangement with the Electrical Workers' Union and the Chicago Switchboard Manufacturers' Association in 1911, under the terms of which, according to the indictment, it was agreed to keep goods made in outside cities out of the Chicago market. The defendants in this case are charged with conspiracy, with maintaining a combine in restraint of trade, and with

entering into a contract to carry out these purposes in violation of the Sherman Law. Another indictment charges the union officials and the employers and contractors with naming and fixing prices of fixtures, preventing the installation of fixtures unless handled by members of the contractors' organization and members of the union. The individual contractors are charged jointly with their firms and corporations, with restraining interstate commerce by maintaining illegal combinations, fixing and keeping prices up and preventing outside-made goods from coming into Chicago. The indictments have been returned against the following firms and individuals:

Abbott Fixture Company, Acme Metal Manufacturing Company, The Baggot Company, David J. Braun Manufacturing Company, Central Electric Company, Central Chandelier Company, Cuthbert Electric Manufacturing Company, Decorators' Supply Company, Delta-Star Electric Company, Electric Apparatus Company, Edwards Lighting Fixture Company, Englewood Chandelier Company, C. G. Everson & Company, H. A. Framburg & Company, Sam Garvin & Company, General Lighting Fixture Company, Helander Fixture Company, Henkel & Best Company, Illinois Mantle and Fixture Company, Independent Fixture Company, Lake View Gas Fixture Company, J. Lang Electric Company, Willy H. Lau Company, Metal Arts and Crafts Company, Model Chandelier Works, Moran & Hastings Manufacturing Company, Moran and Macnair, Henry Newgard & Company, National X-Ray Reflector Company, Victor S. Pearlman & Company, Rush Brothers, Russell Bronze Company, South Side Chandelier Company, States Electric Company, H. B. Van Fossen Manufacturing Company, Walter G. Warren Company, Western Chandelier Company, Wingrave & MacNaughtan Company, R. Williamson & Company, T. W. Wilmarth Company, The W. G. Wood Company, Gustave W. Berthold Electric Apparatus Company; Edward E. Berthold, Electric Apparatus Company; John Cuthbert, president Cuthbert Electric Manufacturing Company; Otis B. Duncan, Lang Electric Company; William J. Feeney, secretary Chicago Lighting Fixture Association; George A. E. Kohler, Kohler Brothers; Franklin Kohler, Kohler Brothers; Charles Kreider, Kohler Brothers; Julian J. Nielsen, States Electric Company; James Obermiller, former official of States Electric Company; Charles J. Peterson, of Cuthbert Electric Company, formerly with Henry Newgard & Company; Allen S. Pearl, Delta-Star Electric Company; Warren Ripple, J. Lang Electric Company; James E. Baggot, David J. Braun, F. Baehker, Nathan Cohn, M. J. C. Corswandt, John Cook, Andrew C. Dallas, Edward Dunne, Carl G. Everson, John Farmer, H. A. Framburg, T. W. Gilmore, Leo J. Georgen, Alfred F. Hanson, Frank Horton, Bernard H. Jones, D. MacNaughtan, Walter Macnair, Edgar C. Moran, Thomas F. Moran, Louis McDonald, Henry Newgard, Martin Newgard, Arthur R. Nordlie, C. G. Ricklefs, Abraham Slevin, Isaac M. Solomon C. E. Ummach.

Standards for Electric Service.

The Bureau of Standards, Washington, D. C., is preparing a circular on the subject of the standards for electric service which can be required by public service commissions or city officials from the electric light and power companies serving the public. This includes the subject of the quality and safety of service, and the accuracy of measurement by the instruments employed. It also deals with certain other public-relations questions.

The announcement says: "One of the most important elements of good lighting service is the use of suitable lamps. In recent years tungsten lamps have been so much improved in efficiency and durability that they are now used much more generally than are carbon or metallized-carbon-filament (Gem) lamps. In recent years tungsten lamps have been so much improved and the selling price so much reduced that the cost of lamp renewals on the average is less with tungsten lamps than with carbon.

"This is due to the fact that the life of the tungsten lamps is more than double that of the others. In actual tests it averages, for the smaller sizes, fully three times as much, and in practice, allowing something for the greater strength of carbon and Gem lamps, it would probably be more than double. The cost is, however, less than twice as much as carbon lamps, and hence the average cost of lamp renewals would be less on the average with tungsten lamps than with the others. The efficiency of tungsten lamps is very much higher, so that there is scarcely any place where carbon or Gem lamps can now be used advantageously. Nevertheless, there are still a good many companies giving free renewals of these lamps to their customers, and this has the tendency to encourge the use of inefficient means of lighting."

One of the clauses of the proposed set of rules being drawn up by the Bureau of Standards is the following:

"Lamps furnished by utilities to customers without charge (free renewals) or at prices less than open market prices should be of such efficiency in watts per candle when used on the utilities' circuits of standard voltage that the cost of light per candlepower-hour to customers will not exceed the cost per candlepower-hour when incandescent lamps are bought in the open market."

While some companies heartily approve of this proposal, it is possible that objection will be made by others, but it is believed that when the facts with regard to the efficiency and durability of tungsten lamps at the present time are fully appreciated by commissions and companies there will be a general disposition to act in accordance with this suggestion.

Program of National District Heating Convention.

The seventh annual convention of the National District Heating Association will be held in Chicago, Ill., on June 1 to 3. Convention headquarters will be at the Hotel Sherman. The following is the program of the convention sessions:

First Session, Tuesday Morning.—Welcome address and response; president's address; report of secretary-treasurer; report of Executive Committee; report of Station Record Committee, by A. P. Biggs, Detroit, Mich., chairman.

Tuesday Afternoon Session.—Paper on "Commercial End of the Heating Business," by C. F. Oehlman, Denver, Colo.; address by Walter A. Shaw, member Public Utilities Commission of Illinois; report of Nominating Committee.

Wednesday Morning Session.—Report of Committee on Underground Construction, by H. A. Woodworth, Indianapolis, Ind., chairman; paper on "Operating Experience with Bleeder-Type Turbines," by F. W. Laas, Cedar Rapids, Iowa; paper by E. F. Tweedy, of New York Edison Company, New York City; election of officers.

Wednesday Afternoon Session.—Report of Public Policy Committee, by D. L. Gaskill, Greenville, O., chairman; address by J. F. Gilchrist, of Commonwealth Edison Company, Chicago; report of Educational Committee, by D. S. Boyden, Boston, Mass., chairman.

Thursday Morning Session.—Paper on "Hot-Water Heating System at the Grand Central Terminal," by W. G. Carlton, New York City; report of Station Operating Committee, by B. T. Gifford, Grand Rapids, Mich., chairman.

Last Session, Thursday Afternoon.—Paper on "A Pressure Study of a Steam Distribution System," by C. C. Wilcox, Jackson, Mich.; paper on "Exhaust Steam vs. Live Steam for Heating," by George W. Martin, New York City.

Special entertainment will be provided for ladies during the convention sessions. On Tuesday evening there will be a theater party for all in attendance. On Wednesday evening is to be given the annual banquet, followed by entertainment and dancing. D. L. Gaskill, Greenville, O., is secretary of the association.

New Electrical and Mechanical Appliances

New Westinghouse Single-Phase Motors.

The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has recently placed on the market a new line of single-phase motors, which are being used extensively for the operation of small machines of all kinds. These motors are known as type AR and range in size from one-half to ten horsepower, inclusive, for 60-cycle circuits.

These motors are very substantially built, are light in weight and extremely compact. Motors of two horsepower and larger are especially designed for industrial service where particularly strong mechanical construction with light weight and good electrical performance are highly desirable. For this reason, steel-frame construction is employed in these sizes of motors, and mechanically they correspond closely to the Westinghouse type CS polyphase motor, which has proven so satisfactory. This type of construction is shown in Fig. 1. Smaller motors have strong cast-iron frames, as shown in Fig. 2. All sizes of motors can easily be adapted for wall or ceiling mounting, and may also be adjusted for clockwise or counter-clockwise direction of rotation in a moment's time. Any motor may be reconnected externally for operation on either 110 or 220-volt circuits.

The motor starts as a repulsion motor, producing large starting torque and taking only a relatively small starting current. A very simple mechanically operated governor, placed within the rotating element, automatically changes the motor from a repulsion to an induction motor as it comes up to speed. Ordinarily a double-pole line switch is the only starting device required, although starters can be furnished to further reduce the starting current. These motors have a very broad application, and can be used upon any 60-cycle single-phase circuit or any phase of a polyphase circuit.

Fig. 1.—Single-Phase Steel-Frame Motor.

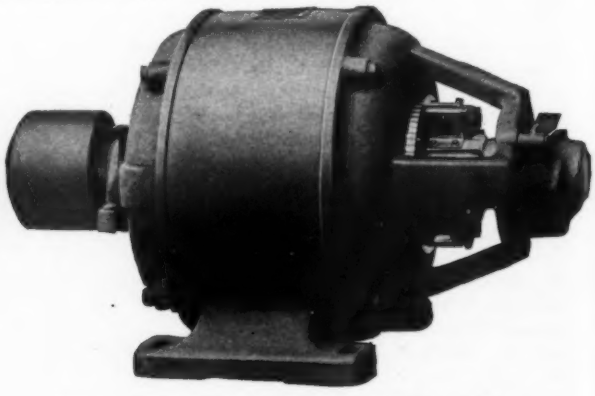


Fig. 2.—Single-Phase Motor With Cast-Iron Frame.

Western Electric Poles for Greece.

Three boat loads of cedar telephone poles have been shipped to Greece. This unusual pole order was received from the Greek government, which will use the poles in extending present telephone facilities. The shipments were made in 45 carloads from the Western Electric Company's concentration yard at Toledo, O., and consisted of 15,000 four-inch top, twenty-foot, and 2,000 five-inch top, twenty-five-foot northern cedar poles of first quality.

Considerable trouble was experienced in obtaining suitable shipping facilities because of the timidity of ship owners, caused by the uncertain safety of shipping in European waters. The 45 cars were thus held up at New York over a month, the delay resulting in a demurrage expense of about $1,000. Eventually, however, three freighters were chartered and the entire shipment, weighing in all 2,000,000 pounds, started on its way on April 3. The poles were personally inspected by the Greek consul general for the United States.

New Small Isolated-Plant Lighting Unit.

The new lighting unit manufactured by the Okey Manufacturing Company, Columbus, O., has several novel features. The gasoline engine is a special design this company has developed for lighting service, and it is not sold except with the dynamo direct-connected as shown in the illustration.

This outfit is made in two styles, the first, known as type F, is equipped for furnishing current direct to the line with no storage-battery auxiliary. This outfit is for service where a certain number of lamps are burned through the entire night, or when the current is required at stated hours only, during which period the engine is operated. The second outfit, known as type FB has an auxiliary storage battery so that current can be had at any time whether or not the engine is running. The battery is of small capacity, the main load being carried by the engine.

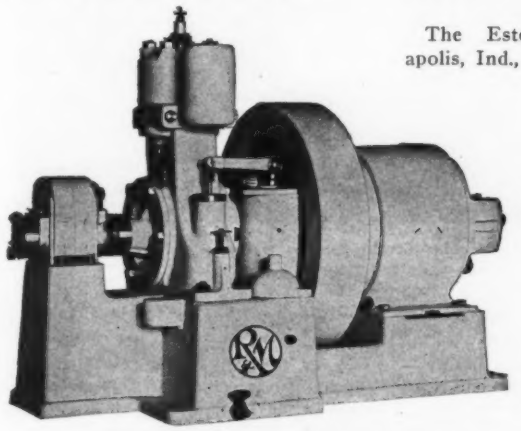
In this second set, a load equivalent to eight 16-candlepower carbon lamps will operate off the battery without starting the engine. As soon as one more lamp is turned on, however, the engine is automatically started, the generator acting as a motor with the battery supplying current until the engine is started.

After the engine has started, it will continue to operate, even though all the lamps are turned off at once, until the battery is completely charged. Then the engine is automatically stopped and the load is transferred

from the generator to the battery. In the event that more than eight lamps are burning when the battery becomes fully charged, the controller cuts off further charge, but leaves the engine running until the lamp load has been reduced below eight lamps; the engine then stops and the load is transferred to the battery.

Two push-buttons are provided on the front of the controller, by means of which the engine may be started or stopped at will, independently of the automatic controller. The controller also is so constructed that it automatically gives the battery an overcharge at every twelfth charge.

The engine is of the single-cylinder, two-cycle type. Excellent regulation is obtained by a throttling governor, which holds the speed within 1.5 per cent above or below normal. The governing mechanism operates in an oil bath. Wherever possible, anti-friction ball bearings are used on the engine. The crank is mounted in ball bearings and the connecting rods are attached to the crank with ball bearings.



Gasoline-Engine-Driven Lighting Generator.

The carbureter is built into the base plate. It has a float feed with a Venturi tube vaporizing nozzle. No valves, springs, cam or dashpots are used or needed. Magnetic control of the float-feed valve is provided, by means of which the engine may be stopped from a distant location by a push-button. This valve also prevents any possible leakage of fuel while the engine is not in operation.

Lubrication is effected by mixing the lubricating oil into the gasoline in the ratio of one quart of oil to ten gallons of gasoline. This method feeds oil in the direct proportion to the load the engine is carrying and also starts and stops with the engine, requiring no attention whatever.

A Bosch high-tension magneto furnishes the current for ignition. It is driven through a noiseless flexible coupling directly from the engine shaft.

The generator is made by the Robbins & Myers Company, Springfield, O. The type F sets are wound for 115 volts and those for the type FB are wound for 42 volts to operate with the 32-volt battery system. The generators for both types are compound-wound to give flat voltage regulation at all loads. The generator is mounted in line with the engine and directly connected to the engine shaft.

The complete equipment of the type F outfit consists of engine with direct-connected generator, 24-gallon tank for cooling water, 10-gallon tank for gasoline, hose for water connection, hose clamps, copper tube for gasoline connection, muffler, extra spark plug, and set of tools.

The type FB outfit, in addition to the above, has a 16-cell Hyray-Exide battery, two counter-electromotive force cells, controller panel of black slate with all instruments supported with angle-iron supports.

Esterline Electric Speed Indicator.

The Esterline Company, Indianapolis, Ind., has placed on the market a new electrical speed indicator, consisting of a specially constructed magneto-type generator and an electrical-speed indicating instrument. The generator is so designed and constructed that the voltage developed by it is directly proportional to the speed at which the armature is driven, and a voltmeter connected to the terminals of the generator indicates, therefore, the true speed of the device to which the generator is coupled.

This type of tachometer has the advantage that the indicating instrument can be located a long distance from the generator, and can be placed where it is not affected by vibration, heat, etc.

The generator is designed especially for speed-indicating purposes. The armature has many slots and a large number of commutator segments. In the construction of the commutator a specially prepared form of mica is used, which wears uniformly with the copper, insuring a smooth brush contact. The armature wires are imbedded in slots and held in place with fiber wedges. The armature rotates on ball bearings of large size. Both bearings are fully housed in dust-tight, oil-containing compartments, so that they will run for months without lubrication or attention. The compartment wall on the commutator end prevents oil from the bearing getting on the commutator, and worn particles of the commutator and brushes from getting into the bearing.

The brush-holders are of special design for this purpose. The brush proper is held in a brass element, which slides accurately and freely in a slot milled in the brush-holder. The construction of the holder is such that the brushes bear on the commutator at an angle instead of radially, insuring smooth action and accurate point of contact at all speeds.

Electric Speed Indicator, Comprising Magneto, Connecting Cord and Voltmeter.

The electrical instruments are of high-grade manufacture, having D'Arsonval movements mounted in cases sheathing them against magnetic fields. They are absolutely "dead beat" and the moving elements are purposely made light in weight, so that they are not affected by vibration. Each instrument has a zero-adjusting device. The instruments can be furnished calibrated to read in any one of the number of different ranges of speed, for revolutions per minute, miles per hour, etc. The makers state that tests

of these instruments, extending over a year's time, show that they are very permanent in their calibration and accurate in their indications.

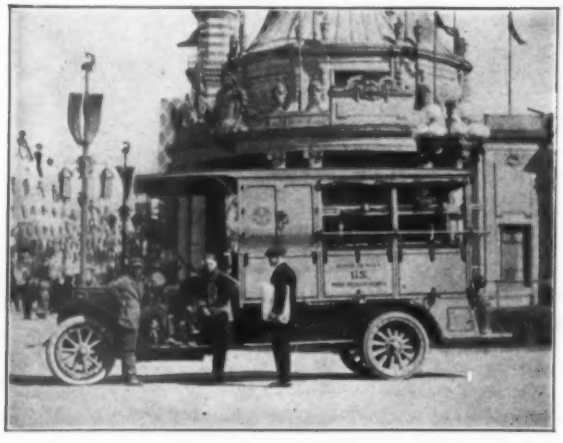
The rugged construction of the generators enables them to be mounted where there is excessive vibration, such as on steam locomotives, street-railway cars, steamships, printing presses and moving machinery. The generators can be either driven by direct connection to shafts or by means of belts or silent chains.

These instruments are applicable to the measuring of speed of any rotating or moving bodies to which the generator can be applied, and have already been successfully adapted to many industrial uses, such as speed of trains, boats, line shafting, printing presses, textile machinery, etc.

Telephones for Use in Mine Rescue Work Demonstrated at San Francisco.

Telephone communication between the advance or rescue party and the outside of the mine, in the case of mine accidents, is one of the features of the daily demonstration of the United States Bureau of Mines rescue crew conducted in connection with the exhibit of the Bureau at the Panama-Pacific International Exposition at San Francisco, Cal.

This exhibit is housed in the Palace of Mines and Minerals, and consists, primarily, of a model mine constructed under the floor of the building in which are installed various appliances, the use of which promotes safety and efficiency in mine work.



Emergency Automobile of United States Bureau of Mines Rescue Corps.

One of the features of this exhibit is the daily rescue drill by a crew of four or five men under the personal supervision of Engineer Edward Steidel, who is in charge of the Bureau's exhibit. Twice a day, in response to a telephone message to the effect that an explosion has occurred in the mine, the rescue crew in its especially designed motor car rushes through the exposition grounds and up to the entrance of the building, and, after putting on oxygen-helmet-breathing apparatus and Western Electric mine-rescue telephone apparatus, the members of the rescue party go into a glass-walled room located on the main floor of the building. This room is filled with smoke and gas fumes and demonstrates that the rescuers can actually breathe and work in the midst of thick smoke and poisonous gases.

Bureau of Mines Rescue Corps Equipped With Oxygen Helmets and Telephones Just Before Entering Mine.

They then go below into the mine and bring out a supposedly injured miner to whom they administer "first aid" treatment. All the time the rescuers are in the smoke-filled room and in the mine they are in constant communication with the outside by means of the telephone equipment.

Each member of the rescue party wears strapped to his throat a small, especially designed transmitter and a watchcase receiver strapped to his ear. This apparatus is connected with a coil of flexible wire, which is carried by the chief of the party on his belt, which pays out as the party advances. The other end of this wire terminates in telephone equipment worn by the person in charge of directing the rescue work located at the rear or on the surface.

The reason for this special equipment is that a man, wearing any of the different types of oxygen helmets which cover his mouth, cannot use the ordinary type of telephone transmitter. The throat transmitter furnished transmits speech practically as well as the standard type of telephone instrument and is very small and light and is provided with a soft rubber cup which assists in holding it firmly against the throat.

In the past, many losses of life have occurred to members of rescue parties which unquestionably could have been avoided, if there had been some means of communicating with the rear to advise when in need of aid which could easily have been given. Another feature of importance is that such an intimate and constant communication with another human being on the outside encourages the rescuer and prevents those sudden waves of overpowering fear which everyone is more or less subject to in times of great danger, particularly when in the darkness and alone.

The mine-rescue telephone equipment demonstrated at the Exposition satisfies this need to the fullest extent and its development has been greatly assisted by suggestions and consultations with the Government Bureau of Mines and private mining companies throughout the country.

In addition to the apparatus above mentioned, the standard Western Electric mine telephones of the iron-box underground type are installed and in operation throughout the model mine in typical locations.

Dale Broadway Lighting Unit.

The requirements of commercial and office buildings in the line of lighting fixtures call for a standardized type of fixture of simple, efficient and durable construction and one which possesses sufficient flexibility so that at minimum cost it may be readily adapted to the different requirements of different sections of the building and to the varying tastes of tenants. A study of these requirements by the Dale Lighting Fixture Company, Incorporated, 107 West Thirteenth Street, New York City, resulted in the development of what is known as the Dale Broadway lighting unit. This outfit is readily adaptable to direct, semi-indirect and pure indirect lighting. This unit is made in various designs of different periods and in the type shown is of simple outline, making it easy to keep clean.

Fig. 1.—Broadway Lighting Unit Arranged for Direct Lighting

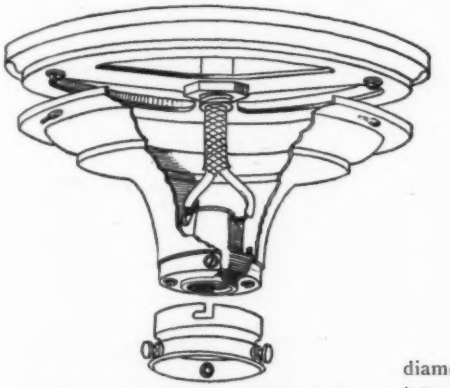


Fig. 2.—View Showing Internal Construction.

Fig. 1 shows one of these units equipped as a direct lighting fixture. The internal construction of this outfit is made clear in Fig. 2. The ceiling plate shown somewhat removed in this latter illustration is fastened directly to the outlet box by means of a lock nut. A conical shell directly below this is provided with keyholes which engage screws projecting from the ceiling plate. The outlet wires are connected directly to a 660-watt porcelain receptacle without requiring any wire splicing or insulating joint. Consequently the fixture is very quickly installed and easily dismantled for inspection or for conversion into one of the other types of unit. Shown at the bottom in Fig. 2 is the detachable shade-holder, which is made in all standard sizes. The diameter of this unit at the ceiling is ten inches and its depth, without glassware, is six inches.

A very simple attachment can be furnished for converting the unit shown in Figs. 1 and 2 into the type of semi-indirect fixture shown in Fig. 3. This attachment is affixed by merely removing the shade-holder referred to in the above.

By taking one or more links from the suspension chains the bowl may be adjusted to give the proper light distribution for various sizes of lamps up to 1,000 watts. If the bowl is to hang some considerable distance below the ceiling, then the chains are brought up to the base of the extended canopy and a fixture stem of appropriate length is inserted to carry the socket at the proper distance.

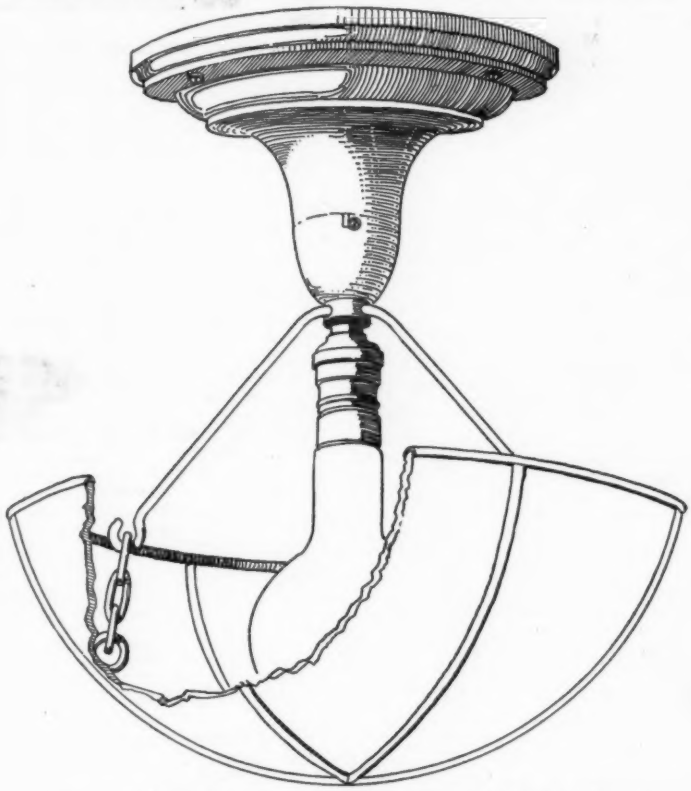


Fig. 3.—Dale Lighting Unit Arranged for Semi-Indirect Lighting.

Electricity in Photographic Arts.

One of the interesting features of the International Exposition of Photographic Arts and Industries held at Grand Central Palace, New York City, was the part which electricity plays in the modern photographic studio and workshop. The time has come when daylight can be dispensed with in the studio and the most delicate and artistic portrait work accomplished with the recently perfected types of electric illuminants. One of these which was shown at the Exposition was a weird looking contrivance resembling a tipped bell, which contained a 1,000-watt type C unit. The rays of light were diffused through a fabric. Another type was a mercury-arc tube similar to those used in motion-picture studios, except that the tubes were suspended horizontally in alternately white and red troughs. In the photographic workshop printing is now done by electricity, prints and negatives are dried quickly by heated air blown over them by an electric fan, developing and printing fluids and chemicals are heated and kept at an even temperature by electricity and powerful electric arcs are used for copying.

Latest Approved Fittings

CABINETS.—The Federal Electric Company, Pittsburgh, Pa.

Cabinets shown by tests and examinations conducted by Underwriters' Laboratories, to be in accordance with requirements of the National Board of Fire Underwriters, have labels attached.

Listed April 7, 1915.

CONDUIT OUTLET BUSHINGS, COUPLINGS AND FITTINGS.—Chicago Fuse Manufacturing Company, 1014 West Congress Street, Chicago, Ill.

Type R outlet bushings and couplings made of coppered steel, for securing unthreaded half-inch rigid conduit at outside.

Listed April 1, 1915.

HEATERS, Electric—Good Housekeeping Cooker Company, Berkeley, Cal.

Good Housekeeper Cooker, 550 watts, 110 volts.

This device is similar to a fireless cooker, but has a heating element and steam-controlled switch for heat regulation located in bottom of an inner compartment, the device being formed of two sheet-metal jackets filled with cork and mineral wool.

Listed April 2, 1915.

HEATERS, Electric, Stand for Pressing Iron.—E. P. McKinney, 188 State Street, Binghamton, N. Y.

Protector. Nickel-plated steel stand, made of two pieces of steel, riveted together and separated by two asbestos disks.

Standard only for electric pressing irons consuming 660 watts, or less.

Listed April 5, 1915.

LIGHTNING RODS.—Eclipse Rod Company, 85 Porter Street, Detroit, Mich.

Labeled.

Listed April 8, 1915.

LIGHTNING RODS.—Goshen Lightning Rod Company, Goshen, Ind.

Labeled.

Listed April 8, 1915

LIGHTNING RODS.—George R. Kress Company, 1900 Brighton Road, Pittsburgh, Pa.

Labeled.

Listed April 8, 1915.

LIGHTNING RODS. — Reyburn, Hunter & Company, 488 North American Street, Philadelphia, Pa.

Labeled.

Listed April 8, 1915.

RECEPTACLES, Standard. — The Bryant Electric Company, Bridgeport, Conn.

"Bryant" or "Perkins" metal-shell, closed or slotted bases.

Keyless, 660 watts, 250 volts, catalog No. 88258.

Listed April 3, 1915.

The electrical fittings illustrated and described in this department have been approved by the Underwriters' Laboratories, Incorporated, following examination and tests conducted under standards of the National Electrical Code as recommended by the National Fire Protection Association.

ROSETTES, Fuseless.—The Arrow Electric Company, 103 Hawthorne Street, Hartford, Conn.

Arrow E rosettes, with pull socket mechanisms.

Three amperes, 125 volts, 1 ampere, 250 volts, catalog Nos. 176, 179, 182, 185, 188, 487, 496, 499, 8588, 8597, 8600, 8605, 8608, 8611, 8614, 8617.

Listed March 30, 1915.

SIGNS, Electric. — Northwestern Electric Works, 7-10-22 Corn Exchange, Minneapolis, Minn.

Electric signs shown by tests and examinations conducted by Underwriters' Laboratories to be in accordance with requirements of the National Board of Fire Underwriters have labels attached.

Listed March 31, 1915.

SOCKETS, Standard.—The Arrow Electric Company, 103 Hawthorne Street, Hartford, Conn.

Arrow E, porcelain shell. Keyless, 1,500 watts, 600 volts, catalog Nos. 5004, 5009, 5010, 5011, 5014-5018 inclusive.

Standard for use only in places where they will not be exposed to hard usage.

Listed March 30, 1915.

SOCKETS, Standard.—Weber Electric Company, Schenectady, N. Y.

Brass shell.

Key, 250 watts, 250 volts, catalog Nos. 1304, 1306, 1308, 1400, 1493, 61372, 61373, 61573, 61773.

Keyless, 660 watts, 250 volts, catalog Nos. 1305, 1307, 1309, 61374, 61375, 61575, 61775.

Pull, 250 watts, 250 volts, catalog Nos. 1510-27 inclusive.

Also above types with shadeholders attached.

Key types with composition or insulated metal key.

Listed March 31, 1915.

SOCKETS, Weatherproof.—Pass & Seymour, Incorporated, Solvay, N. Y.

Metal shell, porcelain-lined, 660 watts, 250 volts, catalog No. 486.

Listed March 30, 1915.

SOCKETS, Weatherproof.—Weber Electric Company, Schenectady, N. Y.

1,500 watts, 600 volts, catalog Nos. 1427-28.

Listed April 2, 1915.

SWITCHES, Automatic. — National Time Switch Company, South Bend, Ind.

Type C, 20 and 30 amperes, 250 volts, consisting of rotary surface snap switches operated by suitable clock mechanism.

Brush-contact type, 35, 50 and 100 amperes, 250 volts, consisting of double-pole, four-break, laminated copper switches operated by springs tripped by clock mechanism.

Listed April 7, 1915.

SWITCHES, Combination Cutout.—Berry, Skinner & Company, 78 Upper Thames Street, London, England.

Adanac switches, 20 amperes, 250 volts. Spring-actuated, double-pole, double-break plunger-type switches, with cartridge inclosed fuses. These devices are so designed that all current-carrying parts are inclosed in metal case. The switches may be operated without opening case or exposing operator or outside objects to live parts. When case is open, fuse terminals are "dead," thus avoiding shock or injury to operator in replacing or inspecting fuses.

Listed March 30, 1915.

SWITCHES, Fixture.—The Arrow Electric Company, 103 Hawthorne Street, Hartford, Conn.

Arrow E, single-pole, 3 amperes, 125 volts; 1 ampere, 250 volts; catalog Nos. 426, 450, 470-477 inclusive, 479. 481-484 inclusive, 8570-8578 inclusive, 8580, 8582-8585 inclusive.

Single-pole, 0.5 ampere, 125 volts; catalog No. 420.

Listed March 30, 1915.

SWITCHES, Surface Snap.—The Arrow Electric Company, 103 Hawthorne Street, Hartford, Conn.

Arrow E, single-pole, 3 amperes, 125 volts; 1 ampere, 250 volts; catalog Nos. 478, 480, 8579, 8581.

Listed March 30, 1915.

SWITCHES, Surface Snap.—The Arrow Electric Company, 103 Hawthorne Street, Hartford, Conn.

Arrow E, single-pole, 3 amperes, 125 volts; 1 ampere, 250 volts; catalog Nos. 172-175 inclusive, 177, 178, 180, 181, 183, 184, 186, 187, 485, 486, 488-495 inclusive, 497, 498, 8586, 8587, 8589-8596 inclusive, 8598, 8599, 8601-8604 inclusive, 8606, 8607, 8609, 8610, 8612, 8613, 8615, 8616.

Link-fuse bases, cleat, single-pole, 2 amperes, 125 volts, catalog Nos. 191, 192, 8620, 8621.

Listed March 30, 1915.

SWITCHES, Surface Snap, Subbase for.—The Gier and Dail Manufacturing Company, Lansing, Mich.

A pressed-steel base for mounting surface snap switches on lath and plaster walls.

Listed March 31, 1915.

Current Electrical News

ATLANTIC STATES.

LOVELL, ME.—The Lovell Light and Power Company has been organized, with C. E. Fox president, B. E. Brown vice-president, N. F. Fox secretary and treasurer. Preparations are being made for building a dam and work will begin early in August. It is understood that the company will furnish electricity to Lovell and the surrounding towns of Waterford, North Waterford, Stowe and Stoneham.

CHICOPEE FALLS, MASS.—The plant of the Fisk Rubber Company is to be greatly enlarged. This plant contains a large installation of electric motors for operating various machinery. W.

BINGHAMTON, N. Y.—The Binghamton Light, Heat and Power Company has been reorganized. It is announced that the three principal properties of the Atlantic Gas and Electric Company would be bought by the General Gas and Electric Company. The properties include the plants in Binghamton, N. Y.; Sayre, Pa., and Easton, Pa. The officers elected for the Binghamton Light, Heat and Power Company are: W. S. Barstow, president; S. H. Dailey, vice-president and general manager. Directors: Frank B. Newell, Thomas B. Crary, George W. Topliff, S. H. Dailey, W. S. Barstow, C. F. Taylor and P. T. Hanscom.

LAKE PLACID, N. Y.—The Public Service Commission has approved of the extension of the electric lighting service to several adjacent sections of the town of North Elba, Essex County

LAUREL, DEL.—The largest, as well as the most far-reaching, financial deal ever consummated on the Delaware Peninsula has been completed with the consolidation of the Sussex Light and Power Company, of Laurel; the Salisbury Light, Heat and Power Company, Salisbury, Md.; the Cambridge, Md., Gas and Electric Company; the Georgetown Electric Company; the Milton, Del., Electric Company, and several smaller lighting and power companies. The corporation is capitalized at $1,000,000.

EASTON, PA.—The contract for the erection of the new $100,000 chapel at Lafayette College here has been awarded to F. L. Hoove & Son, of Philadelphia, Pa. Carrere & Hastings, New York City. are the architects in charge, and the date of completion of the work was given as March 31, 1916. The electrical equipment will be very elaborate.

NORTH CENTRAL STATES.

HILLIARD, O.—LoRoy Bobyns, T. C. Latham and others are interested in the Hilliard Light and Power Company for which incorporation papers were recently secured, and which proposes to build an electric power plant. The capital stock of the company is $10,000. L.

LISBON, O.—An electric plant will probably be constructed by the Ohio Gas and Electric Company, recently incorporated here by J. L. Lackner, J. S. Grayden and others, for that purpose. L.

LORAIN, O.—After several months of investigation, the Lorain city council has decided to call a special election early this summer for a vote upon the issuing of $350,000 in bonds for a municipal lighting and power plant.

MT. BLANCHARD, O.—Bonds to the amount of $3,600 have been disposed of by the village council, for the purpose of providing funds for the construction of a small electric street-lighting plant. L

HAMMOND, IND.—The Northern Indiana Gas and Electric Company, operating in Hammond, East Chicago, Whiting, Michigan City and several smaller towns, has elected the following officers: President, Clarence H. Geist, Philadelphia; vice-president, B. S. Walters, South Bend; secretary, G. W. Curran, Hammond; treasurer, H. C. Miller. The officers, with the exception of Mr. Curran, and including Walton Clark of Philadelphia, and C. N. Chubb of Michigan City, constitute the board of directors. B. S. Walters succeeds W. D. Ray of Hammond as manager and vice-president.

RICHMOND, IND.—The city council, of Richmond, Ind., has voted to condemn the Richmond electric plant owned by the United Gas and Electric Company, of New York, and purchase it for the purpose of supplementing the city's municipal plant.

ELIZABETH, ILL.—The sum of $8,000 has been subscribed to install an electric power plant. Address city clerk.

LANARK, ILL.—The council is planning ways and means to install a municipal lighting plant. Address city clerk.

PETOSKEY, MICH.—Plans are now being prepared for the erection of a municipal electric power plant by the city of Petoskey, on Sturgeon River, 12 miles east of this city, to supply current for lights and electric power in the city. The business has almost outgrown the present municipal plant on Bear River. The new plan would develop 1,250 horsepower. Address city engineer.

TEKONSHA, MICH.—The Tekonsha electric light plant will not be sold, but will be retained and operated by the present incorporators of the Tekonsha Electric Company. The company expects to add to and improve the plant to be ready to meet every demand made upon it.

ASHLAND, WIS.—The local electric company is planning a 10,000-kilowatt enlargement to its plant as well as the addition of a 5,000-kilowatt steam turbine plant. A double transmission line is also to be built.

ODANAH, WIS.—This village has voted to grant a franchise to the Odanah Electric Light, Power & Telephone Company, to D. U. Parkinson, of Ashland. The work will be begun as soon as possible, and it is expected that telephone service will be installed before the end of May. Electric street lighting will also be put in as soon as the work can be done.

OSLO, WIS.—The capital stock of the Oslo Light and Power Company has been increased from $5,000 to $30,000, the purpose being to reconstruct the hydroelectric plant which was damaged by floods.

MINNEAPOLIS, MINN.—An option on a dam site and flowage lands on Wolf River has been taken by the Municipal Light and Power Company of Shawano, Wis., for the purpose of erecting a hydroelectric plant which will cost about $50,000. Plans and estimates are being made by the Power Engineering Company, Minneapolis.

STILLWATER, MINN.—Earl D. Jackson, of St. Paul, consulting engineer, has been directed by the lighting committee of the Stillwater city council to prepare alternative plans for a street lighting system, together with a plan for a municipal lighting plant.

BROOKINGS, S. D.—An addition is to be built to the municipal power plant within the next few months. The equipment to be purchased will include two 66-foot horizontal boilers and water heaters, two generating units of 200-kilowatt and 120-kilowatt capacity, respectively. 2,200 volts, two-phase, 60-cycle, direct-connected. A switchboard will also be wanted. A. W. Morrison is superintendent of the plant.

WESSINGTON, S. D.—This village will in all likelihood soon have an electric lighting system. R. W. Stoner and C. J. Stoner, investors of Iroquois, are considering the field.

COUNCIL BLUFFS, IOWA.—The council is planning ways and means to install a city lighting plant. Address city clerk.

URICH, MO.—The city is having plans prepared for an electric light plant to cost $5,000. H. Busse is interested.

WELLSVILLE, MO.—The Wellsville Light, Power and Water Company has been sold to C. H. Lawrence of St. Louis, who has taken charge and will make a number of improvements in the service.

SOUTH CENTRAL STATES.

HARLAN, KY.—The Kentucky Utilities Company has begun construction of a new transmission line in this section. This will lead off at Harlan, cross the Cumberland River, and proceeding up the mountain to Wilhoit, thence to the head of Terry's Fork

to the plant of the Terry's Fork Coal Company and thence to Varilla, connecting with the Middlesboro line, Varilla being the location of one of the power plants.

LOUISVILLE, KY.—Loomis & Hartman, architects, offices in the Todd Building, are preparing plans for a four-story mercantile building to be erected on the Speed property, Fourth Street between Walnut and Chestnut. June 1 has been named as the date for taking bids on the elevators, electrical wiring, etc.

NEW HAVEN, KY.—The new electric light plant of R. A. Greenwell here, equipped with new machinery, has been put in commission.

LONGVIEW, TEX.—The Longview Ice and Electric Light plant has been purchased by the American Public Service Corporation of New York, and extensive improvements are to be made.

RIO GRANDE, TEX.—The Star Telephone Company is preparing to extend its line up the valley of the Rio Grande to Laredo, a distance of 122 miles. The proposed extension will connect the towns of Rio Grande with Roma, Zapata and a number of small villages and ranches. It will connect with the Southwestern Telegraph and Telephone Company's long-distance system at Laredo.

THRALL, TEX.—The Thrall Telephone Company has been organized, with a capital stock of $6,000. Incorporators: A. C. Dollahon, A. E. Probst and Y. F. Hopkins.

WESTERN STATES.

PIOCHE, NEV.—The Panaca Water, Irrigation and Power Company has been incorporated here by Henry Mathews, David Keele and E. R. Phillips.

CASA GRANDE, ARIZ.—People of this city have voted to grant E. R. Brackett a franchise to operate an electric light and power plant here. The installation of the plant, including poles and wires, will cost between $150,000 and $200,000.

BREMERTON, WASH. — According to advices received at the Puget Sound Navy Yard, here, the Navy Department, Washington, D. C., will immediately begin the construction of a new high-power radio station on Puget Sound, probably at Keyport, near here. The proposed plant will be one of the most modern high-power stations yet built, with towers from 300 to 400 feet high. It is also reported that a station is to be built by the Navy Department on the Copper River Flats, near Cordova, Alaska. O.

EVERETT, WASH.—Scott Calhoun, Alaska Building, representing the Washington Power Company, which has power holdings in the Sultan Basin near Everett, is negotiating with the city of Everett for the sale of his company's power rights in the Sultan Basin. The proposition is being given consideration by the City Council. O.

NORTH YAKIMA, WASH.—Application has been made by the Pacific Power and Light Company to the county commissioners for a 50-year franchise for extensions, amounting to about three miles, to its power lines in the Moxee Valley, and half a mile to the Naches power station. The latter line is to be extended to serve a pumping plant which W. R. Howe is constructing.

SEATTLE, WASH. — The Port Commission, Central Building, C. E. Remsberg, Secretary, has awarded the contract for the installation of a lighting and power system in the fruit storage building, East Waterway Terminal Improvement of the Port of Seattle, to the Rainier Electric Company, 208 Columbia Street, Seattle, on its bid of $3,543. O.

ASTORIA, ORE. — The county court, Clatsop County, has granted a franchise to the Pacific Power & Light Company for the erection of electric transmission lines along the public highways in Clatsop County. Reported active construction will begin as soon as materials can be placed on the ground. O.

LA PINE, ORE.—It is reported the Pringle Falls Electric and Water Power Company, which recently completed the construction of a power plant at Pringle Falls, will extend the electric transmission lines to Fort Rock, Fremont and Crescent. The concern is installing machinery in its new plant at this time. O.

FRESNO, CAL.—The San Joaquin Light and Power Company will build a new $75,000 hydroelectric plant at Merced Falls. The power line from Merced Falls to Merced will be raised from 30,000 to 60,000 volts. The plant will supply Merced County, the mines of Mariposa County and gold dredgers working on the Merced River near Merced Falls.

LOS ANGELES, CAL.—Property owners in Francisco Park have petitioned for an ornamental lighting system.

ORANGE, CAL.—A proposition for the formation of the El Modena Lighting District carried at a special election a few days ago, and a lighting system will be installed immediately.

TEHACHAPI, CAL.—At a recent election bonds in the sum of $2,000 were voted to provide a lighting system for this town.

FOREIGN TRADE OPPORTUNITIES.

[Addresses may be obtained from the Bureau of Foreign and Domestic Commerce, Washington, D. C., or its branch offices at Boston, New York, Atlanta, Chicago, St. Louis, New Orleans, Seattle and San Francisco. Write on separate sheet for each item and give file number.]

NO. 16,428. ELECTRICAL SUPPLIES.—A firm in Italy informs an American consular officer that it desires to receive catalogs, prices, etc., from American firms manufacturing electrical supplies and electric motors, etc.

NO. 16,436. POWER PLANT.—An American consular officer in Latin America reports that it is understood that a concession for an electric power and light plant for a town of 7,000 inhabitants will be let to an American corporation in the near future. It is stated that the corporation now controls a number of public utilities. The power plant will probably be operated by steam at first and later by water power.

NO. 16,446. X-RAY APPARATUS.—An American consular officer in Spain reports that a business man in Africa desires to import X-ray apparatus. Correspondence and catalogs should be in the Spanish language to be considered.

NO. 16,451. ELECTRIC WIRES, ETC.—The Bureau of Foreign and Domestic Commerce is in receipt of a letter from a business firm in the United States transmitting a communication from a firm in Switzerland which desires to purchase electric wires and ribbons. Samples are requested.

NO. 16,454. COPPER WIRE AND CORE SHEETS.—A business man in Spain desires to communicate with American manufacturers and exporters of copper wire, ingots and sheets for the manufacture of dynamos, motors, etc., and material for insulating the wire, etc.

NO. 16,458. SEARCHLIGHTS.—An American consular officer in one of the neutral European countries writes that a firm in his district desires to receive offers from American manufacturers who are in a position to deliver electric searchlights for military purposes.

NO. 16,517. ELECTRIC HEATING AND COOKING APPARATUS.—A manufacturer in Switzerland informs an American consular officer that he desires to communicate with American manufacturers of electrical heating and cooking apparatus and electrical soldering devices. Catalogs, price lists, etc., should be sent at once. Quotations should be made f. o. b. New York.

NO. 16,531. WIRE FOR ELECTRICAL FOOT WARMERS.—One of the foreign legations in Washington informs the Bureau of Foreign and Domestic Commerce that a manufacturer of electrical foot warmers is in the market for the necessary wire. He needs fine nickeline, excelsior and chrome-nickel wire of great electrical resistance, sizes 0.05 to 3 millimeters. Samples should be supplied. A pamphlet illustrating foot warmers may be seen at the bureau and its branch offices.

NO. 16,545. ELECTRIC SWITCHES.—The commercial agent of the Bureau of Foreign and Domestic Commerce in New York City has transmitted an electric switch and a detailed report relative thereto. A firm in New York City desires to purchase these switches with a view to exporting them to Australia. A detailed report may be had on application, and the switch may be examined at the bureau or its branch offices.

PROPOSALS.

SEATTLE, WASH.—Sealed proposals will be received by the Board of Public Works, A. L. Valentince, chairman, until May 7, for furnishing and installing boiler, super-heater, piping, etc., in the Lake Union steam plant, auxiliary to the municipal power plant. Plans and specifications on file with the Board of Public Works, city hall.

STEEL RADIO TOWERS.—Sealed proposals indorsed "Proposals for two 300-foot steel towers," will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until May 29, for the construction of two 300-foot steel towers for the radio station at Point Isabel, Tex. Plans and specifications may be obtained on application to the Bureau.

REDWOOD FALLS, MINN.—The Board of Education has advertised for bids for alterations and additions to a high school. The electric contract will be separate. Plans and specifications are on file at the offices of

the board and the architects, Tyre and Chapman, 320 Auditorium building, Minneapolis. Bids will be received by the secretary of the school board. H. M. Aune, until May 25.

NEW PUBLICATIONS.

CANADIAN MINES REPORT—The Canadian Department of Mines has issued a summary report of the Mines Branch for the calendar year 1913. This is profusely illustrated and covers the laboratory work, field work, office work and various individual reports.

PHYSICAL PROPERTIES OF COBALT.—The Canadian Government Department of Mines, Ottawa, Canada, has issued a report on "The Physical Properties of the Metal Cobalt," written by H. T. Kalmus and C. Harper. The Observations were obtained during researches on cobalt and cobalt alloys conducted at Queens University, Kingston, Ont. The report covers over 70 pages and includes many fine full-page plates of microphotographs.

ELECTRIC FURNACE SMELTING.—The Bureau of Mines, Washington, D. C., has issued Bulletin 81, entitled "The Smelting of Copper Ores in the Electric Furnace," by Dorsey A. Lyon and Robert M. Keeney. This is a pamphlet of 80 pages, which considers experiments carried out on Michigan copper ores. The practicability of the methods depends mainly upon the relative cost of coke and electric power.

ELECTRICAL SAFETY CODE.—The Bureau of Standards, Washington, D. C., has prepared a preliminary edition of Circular No. 54, entitled "Proposed National Electrical Safety Code," for discussion and criticism. This circular contains three parts, a fourth dealing with operating rules having been published last year. The object of this code is to cover hazards to life in somewhat the same manner that the National Electrical Code has been developed for protection from fire hazards.

TESTING OF MATERIALS.—The Bureau of Standards (Washington, D. C.) is distributing free upon request its publication entitled "The Testing of Materials." This is of special interest to manufacturers, jobbers, and merchants, and since quality is so important a factor in securing foreign trade, the subject is one of great importance to exporters. The pamphlet has 89 pages dealing with such subjects as metals and alloys, cements, clay products, lime, stone, paint materials, bituminous materials, inks, paper, textiles, rubber, leather, lubricating oils and greases, chemicals, and materials intended for technical use, such as electrical materials, optical materials, thermal materials, etc.

NEW INCORPORATIONS.

PRAIRIE GROVE, ARK.—The Prairie Grove Electric Company has been incorporated with a capital of $6,000 by J. T. Carl and others.

CANAL DOVER, O.—The Braun-Hof Electric Company has filed amended articles of incorporation changing its name to the Braun Electric Manufacturing Company.

BUFFALO, N. Y.—Bison Electrical Company, Incorporated; electrical contracting, etc. Capital, $25,000. Incorporators: Joseph T. Arundell, Bert H. Fisher and F. M. Smith.

NEW YORK, N. Y.—New York Electric Lamp Company, Incorporated. Capital, $500. Incorporators: Florence M. Ekstrom, Ernest W. Botce and Henry E. Hoyt, all of New York City.

NEW YORK, N. Y.—The Globe Multiple Fuse and Electrical Manufacturing Company, Incorporated. Capital, $25,000. Incorporators: Louis H. Ferber, Brooklyn, N. Y., and Irene Gennis and K. Arvid Enlind of New York City.

CONNEAUT, O.—The H. D. Thayer Electric & Hardware Company has been incorporated here, with a capital stock of $15,000, by H. D. Thayer and others. The company will handle electrical supplies and conduct a contracting business.

PITTSBURGH, PA.—The Standard Electric and Manufacturing Company was recently incorporated with a capital of $10,000. The incorporators are Benjamin Raphael, formerly of the Raphael Electric Company; Max I. Amdursky and Joseph Goldstein, all of Pittsburgh. S.

CHICAGO, ILL.—The Marquette Electric Engineering Company has been incorporated with a capital stock of $15,000. The company will manufacture and deal in electrical machinery and supplies. Adolph C. G. Anderson, Edwin A. Fritsch and Hugo Fritsch are the incorporators. Z.

NEW YORK, N. Y.—The Sibley-Pitman Electric Corporation has been formed with a capital of $150,000, to manufacture electric apparatus, etc. The incorporators are Ernest B. Latham, Dunellen, N. J.; Willis M. Deming, Schenectady, N. Y., and Thomas M. Debevoise, Summit, N. J.

FINANCIAL NOTES.

There has been placed on the regular list of the Philadelphia Stock Exchange $875,600 additional stock of the American Telephone & Telegraph Company.

Under the terms of a plan agreed on yesterday by the Board of Directors, the Interborough-Metropolitan Company, holding company for the Interborough Rapid Transit Company and other traction companies in this city, is to be consolidated with the Finance and Holding Corporation, a small company organized with common stock without par value. They will be merged in a new corporation with a capital stock of approximately $50,000,000. A name for the reorganized company has not yet been agreed upon. The new company cannot become a reality, in accordance with the New York State corporation law of 1912, unless two-thirds of both the preferred and the common stock vote in favor of the plan. A meeting of the stockholders to pass on the plan has been set for June 30. It is specifically set forth in the plan that it is not the intention of either the Proxy Committee of the Interborough-Metropolitan preferred stock or the voting trustees of the common stock to vote for the reorganization of the Interborough-Metropolitan "until general consent shall have been obtained, at least from the holders of the preferred shares." There is outstanding $47,740,000 of 5 per cent cumulative preferred stock and $93,262,192 of common stock.

Dividends.

	Term.	Rate.	Payable.
Cape Breton Elec. pf.	S-A	$3.00	May 1
Cape Breton Elec. com.	S-A	$1.50	May 1
Conn. Ry. & Lt. pf.	Q	1%	May 15
East St. Louis & Sub. pf.	Q	0.75%	May 1
Havana El. Ry., Lt. & Pr. pf.	S-A	$3.00	May 15
Havana El. Ry., Lt. & Pr. com.	S-A	$2.50	May 15
Kaministiquia Pr.	Q	1.5%	May 15
Kellogg Switch & Sup.	Q	3%	April 30
Marconi Wireless cum. part. pref. 1914	—	7%	
Montreal Lt., Ht. & Pr.	Q	2.5%	May 15
National Carbon	Q	1.75%	May 15
North Am.	Q	1.25%	July 1
Pac. Pr. & Lt. pf.	Q	1.75%	May 1
So. Cal. Edison com.	Q	$1.50	May 15
Virginia Ry. pf.	S-A	2.5%	May 1
Virginia Ry. com.	S-A	1%	May 1
Wash.-Va. Ry.	S-A	1%	May 1
Wash.-Va. Ry. pf.	S-A	2.5%	May 1
West Penn. Rys. pf.	Q	1.25%	May 1

Reports of Earnings.

COLUMBUS RAILWAY, POWER & LIGHT.

	1915	1914
February gross	$ 248,596	$ 246,540
Net after taxes	99,532	92,474
Surplus after charges	60,855	52,009
Twelve months' gross	3,071,080	3,001,131
Net after taxes	1,197,157	1,057,273
Surplus after charges	721,072	567,126
Balance after preferred dividends	435,949	282,003

KINGS COUNTY ELECTRIC LIGHT & POWER.

The combined statement of the Kings County Electric Light & Power Company and Edison Electric Illuminating Company of Brooklyn for the quarter ended March 31, 1915, compares as follows:

	1915	1914
Gross	$1,754,248	$1,652,743
Net after taxes and depreciation	643,663	596,849
Other income	11,715	16,259
Total income	655,382	613,109
Surplus after charges	438,595	395,542

DAYTON POWER & LIGHT.

	1915	1914
March gross	$ 86,559	$77,390
Net	37,790	33,719
Surplus	19,569	16,725
Three months' gross	276,726	245,439
Net	131,996	106,837
Surplus	78,151	55,002

DETROIT EDISON COMPANY.

The Detroit Edison Company, one of the subsidiaries of the North American Company, reports earnings from all constituent companies as follows:

	1915	1914
March gross	$ 653,657	$ 546,741
Net earnings	241,736	190,423
Surplus after charges	160,194	121,794
Three months' gross	2,011,361	1,703,402
Net earnings	797,883	633,462
Surplus after charges	549,050	429,804

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

	Apr. 26	Apr. 19.
American Tel. & Tel. (New York)	121¼	123⅛
Commonwealth Edison (Chicago)	136	136
Edison Electric Illuminating (Boston)	245	244
Electric Storage Battery common (Philadelphia)	52½	50¼
Electric Storage Battery preferred (Philadelphia)	52½	50¼
General Electric (New York)	152	154
Kings County Electric (New York)	119	119
Massachusetts Electric common (Boston)	7	—
Massachusetts Electric preferred (Boston)	42½	43
National Carbon common (Chicago)	—	137
National Carbon preferred (Chicago)	119½	119½
New England Telephone (Boston)	128	128¼
Philadelphia Electric (Philadelphia)	24⅜	24⅜
Postal Telegraph and Cables common (New York)	80	78½
Postal Telegraph and Cables preferred (New York)	67½	68½
Western Union (New York)	68¼	67½
Westinghouse common (New York)	86¾	86
Westinghouse preferred (New York)	120	120

PERSONAL MENTION.

PROF. C. M. JANSKY, of the University of Wisconsin, has been appointed upon the Jury of Awards in the Electrical Group for the Panama-Pacific International Exposition, and left this week for San Francisco.

MR. M. H. CLAPP, superintendent of telegraphs for the Northern Pacific Railway Company, read a paper on April 27 before the Telephone Society of New York on "A Comparison of the Application of the Telephone in Commercial Companies With Its Application to Steam-Railway Operation."

MR. F. M. TAIT, president of the Dayton Power and Light Company, of Dayton, O., who will leave shortly to become associated in New York with the Messrs. Brady, sons of the late Anthony N. Brady, of 54 Wall Street, will be the guest of honor at a dinner tendered by the Dayton Jovians on the evening of May 11. Other guests will include leading business men of the city, and President D. L. Gaskill, of the Greenville Electric Light and Power Company, and secretary of the Ohio Electric Light Association, will preside as toastmaster. H. H. Scott, of New York, president of the National Electric Light Association, is to be one of the speakers. Mr. Tait will continue as president of the Dayton company.

MR. ROBERT C. FENNER, who for the past nine years has been connected with the Cutler-Hammer Manufacturing Company, of Milwaukee, Wis., has resigned as manager of the Chicago office of that company and has opened an office of his own in the Peoples Gas Building, Chicago, where he is acting as manager of sales for a number of mechanical and electrical specialties. Mr. Fenner is well known in electrical circles in the East, having been for three years manager of the Boston office of the Cutler-Hammer Company. Prior to that he was an instructor in physics at Cornell. He graduated from that university in 1903 with the degree of M. E., and was affiliated with the Theta Xi and Sigma Xi fraternities. Mr. Fenner is a member of the American Institute of Electrical Engineers and of the University Club of Chicago, and has taken an active part in the work of the Chicago Association of Commerce, being chairman of the electrical subdivision

Robert C. Fenner.

of that association and a member of its ways and means council.

MR. OTIS B. DUNCAN, for a number of years general manager of the J.

Otis B. Duncan.

Lang Electric Company, Chicago, will continue to represent that organization as the Chicago manager of the George Cutter Company, of South Bend, Ind. Mr. Duncan is a native of New York, and has long been identified with the electrical industry, coming to Chicago from Wichita, Kans., where he was assistant superintendent of the Wichita Railroad and Light Company. He was employed in Chicago by the Western Electric Company for four years, and at the time he became associated with the J. Lang Electric Company he was employed by the Western as special traveling sales representative on alternating-current machinery. Mr. Duncan has a wide acquaintance in Chicago and adjacent cities, and has taken a prominent part in many civic and electrical association activities.

DATES AHEAD.

National Fire Protection Association. Annual convention, New York City, May 11-13. Secretary, F. H. Wentworth, Boston, Mass.

Arkansas Association of Public Utility Operators. Annual meeting, Little Rock, May 11-13. Secretary, W. J. Tharp, Little Rock, Ark.

Arkansas Association of Electrical Contractors. Annual meeting, Little Rock, May 12-13. Secretary, J. C. Dice, Little Rock, Ark.

Gas, Electric and Street Railway Association of Oklahoma. Fourth annual convention, Oklahoma City, May 12-14. Secretary, H. V. Bozell, Norman, Okla.

Southwestern Electrical and Gas Association. Eleventh annual convention, Galveston, Tex., May 19-22. Secretary, H. S. Cooper, 405 Slaughter Building, Dallas, Tex.

Missouri Public Utilities Association, Annual convention, Steamer *Quincy*, May 27-30. Secretary, F. D. Beardslee, 315 North Twelfth Street, St. Louis, Mo.

National District Heating Association. Annual convention, Hotel Sherman, Chicago, Ill., June 1-3. Secretary, D. L. Gaskill, Greenville, O.

National Electric Light Association. Annual convention, San Francisco, Cal., June 7-11. Secretary, T. C. Martin, 29 West Thirty-ninth Street, New York, N. Y.

National Electrical Contractors' Association of the United States. Fifteenth annual convention, San Francisco, Cal., July 21-24. Secretary, George H. Duffield, 41 Martin Building, Utica, N. Y.

With the Electrical Manufacturers

The P. & B. Manufacturing Company, Milwaukee, Wis., is moving into its new factory at 189 Fifth Street, where it will have six times its present floor space. The company has appointed A. Hall Berry, 97 Warren Street, New York City, as its eastern representative.

The Hart Manufacturing Company, Hartford, Conn., manufacturer of "Diamond H" switches and appliances, has removed its New York City office to Room 1034, Hudson Terminal Building, 30 Church Street. This office is in charge of Frank E. Watts, well known as past Jupiter of the Jovian Order.

Crocker-Wheeler Company, Ampere, N. J., has issued bulletin No. 166, dealing with its starters for induction motors with squirrel-cage rotors. These starters possess several distinctive features which are described in the bulletin. Over a dozen views of different types of these starters are shown. These devices are built for motors ranging from 2 to 200 horsepower.

The Meadows Manufacturing Company, Pontiac, Ill., has ready for distribution among dealers of washing machines, colored charts or hangers suitable for store or window display. One of these shows the Meadows family bench-type power washer, with shiftable wringer in various positions. The other hanger shows a number of views of the safety electric washer.

The Bell Lumber Company, Minneapolis, Minn., reports a fairly good trade in cedar poles. Among other orders which the company is now filling is one for 45 to 60-foot poles to be used in Kansas City, Kans., for the municipal plant. The Bell company also announces that H. E. Bell has been elected secretary of the company in place of L. H. Lange, who is no longer with the firm.

The Sibley-Pitman Electric Corpora-

tion, New York, N. Y., has been organized to take over the business and assets of Clarence C. Sibley and George D. Pitman, composing the firm of Sibley & Pitman, of New York. The corporation's board of directors consists of E. B. Latham, chairman; Clarence C. Sibley, William M. Deming, Hugh Q. Foreman and George D. Pitman. The officers are: Clarence C. Sibley, president; George D. Pitman, vice-president; Hugh Q. Foreman, secretary and treasurer. The office and salesroom is at 19 West Thirty-sixth Street.

Kerr Turbine Company, Wellsville N. Y., is distributing Bulletin No. 51 on its Economy geared turbines. It explains the great advantages often obtained by interposing gears between turbine and driven generator, pump, blower or pulley, and also explains the new method by which Economy turbine gears are so accurately hobbed that no grinding or polishing is necessary for finish. Gears made in the Kerr shops are said to be so quiet in operation that the gears of an Economy geared turbine really make no more noise than the windage of a direct-connected outfit.

The Richardson-Phenix Company, Milwaukee, Wis., has issued bulletin No. 10 on the Peterson power-plant oil filter and accessory apparatus for central oiling systems. This is a large publication that explains how continuous lubrication may be made automatic and economical by the use of a proper oil filter. The Peterson filter is described in detail and some 50 views are shown of various sizes of it, its principle of operation, detail parts, method of application and typical installations. Lubricating auxiliaries, such as pumps, tanks, etc., are also described.

Harrison Safety Boiler Works, Philadelphia, Pa., issued engineering leaflet No. 18, which deals with the testing of V-notch weirs. The leaflet contains a reprint of two papers on the subject. One of these is by James Barr and gives the results of exhaustive tests of the properties of this type of weir conducted at Glasgow University. The other paper, by W. S. Giele, describes the Cochrane meter-testing plant and its varied facilities for testing weir notches of various angles and heights. This type of weir notch is used in the Cochrane metering heater for measuring boiler-feed water. The accuracy of this type of weir, together with the absence of moving parts in contact with the flowing water, is claimed to make this meter exceptionally valuable.

The David J. Braun Manufacturing Company, which has been conducting a very successful fixture business at Washington and Union Streets, Chicago, has been consolidated with the **Beardslee Chandelier Manufacturing Company,** of Chicago, Ill., the latter firm name being retained for the merged organization and the David J. Braun Manufacturing Company's name discontinued. D. J. Braun and S. D. R. Braun have retired. Charles G. Ricklefs and Daniel Hesly, treasurer and secretary, respectively, of the old Braun firm, and the efficient sales and manufacturing departments of that firm have been transferred to the enlarged Beardslee organization, also the patterns, tools and machinery. The increased design, manufacturing and sales staff and facilities of the Beardslee company permit it to enlarge greatly the scale and scope of its fixture business.

The George Cutter Company, South Bend, Ind., which has controlled the J. Lang Electric Company for the past two years, operating the old factory under that name in Chicago, has decided to close the Chicago plant and to manufacture all of its products in South Bend, under the name of the George Cutter Company. The J. Lang Electric Company was started some 25 years ago by James Lang, who manufactured a line of electrical specialties such as terminals and knife switches. The progress of the company attracted the attention of Warren Ripple and R. S. Ripple, under whose direction the company has had a rapid and substantial development. The J. Lang Electric Company's products will be manufactured at South Bend, and a Chicago office will be maintained at 1311 Steger Building, in charge of Otis B. Duncan, for many years general manager of the J. Lang Electric Company.

The Mitchell Vance Company, New York City, which since its establishment in 1854 has been a leader in the design and manufacture of both artistic and commercial lighting fixtures, has turned over the marketing of its products to **H. W. Johns-Manville Company.** The latter firm now comprises in its organization three distinct divisions of important lighting activities: (1) The Frink and J-M Linolite sysetms of reflectors and lamps for highly specialized and localized illumination; (2) the Mitchell Vance fixtures for esthetic and commercial lighting, and (3) the professional services of lighting specialists and installation services of the construction departments of the numerous Johns-Manville branches in all parts of the country. New lighting showrooms of the organization are at 294 Madison Avenue, New York City, directly adjoining the H. W. Johns-Manville Building.

Record of Electrical Patents.

Issued by the United States Patent Office, April 20, 1915.

1,135,999. Automatic Lighting Control for Vehicles. J. G. Egerton, Memphis, Tenn., assignor of one-third to G. Egerton. Flashes rear danger lamp when going backward.

1,136,006. Dimmer for Automobile-Head-Lights. H. C. Harrison, Lockport, N. Y. Screen between lamp and glass front.

1,136,044 to 1,136,047. Oscillation-Receiving Device. G. W. Pickard, assignor to Wireless Specialty Apparatus Co., Boston, Mass. Four patents on silicon detector used in connection with antimony, arsenic and bismuth contacts.

1,136,058. System of Power Transmission. E. A. Sperry, Cleveland, O., assignor to American Electric & Controller Co. Variable-speed motor regulated by make-and-break device in armature circuit.

1,136,062. Electropneumatic Brake. W. V. Turner, assignor to Westinghouse Air Brake Co., Wilmerding, Pa. Electrically controlled air-brake system.

1,136,075. Storage Battery. P. B. Whitney, assignor to Mesinger-Whitney Electric Co., New York, N. Y. Each cell has venting nipple at one of the upper edges.

1,136,076. Process of Producing Electrical Heating Devices. E. L. Wiegand, Canal Dover, O. Heating element is inserted into cement base.

1,136,078. Electric-Current Generator. J. M. Wilson, assignor to Splitdorf Electrical Co., Newark, N. J. Special field construction.

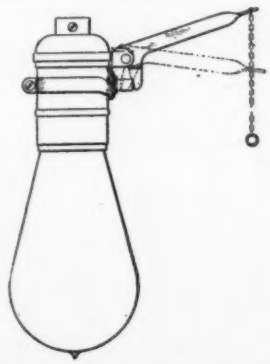
1,136,111. Dowel Connection. R. W. Erwin, assignor to National Carbon Co., Cleveland, O. For carbon-plate terminal of dry cell.

1,136,127. Electrically Heated Tool. J. S. Hansen, assignor to O. A. Miller Treeing Machine Co., Portland, Me. Electric treeing iron.

1,136,139. Corner-Turning Indicator for Automobiles. S. Jackson, Denver, Colo. Electric rear lamp signals.

1,136,165. Electric Drive for Calculating-Machines. N. W. Perkins, Jr., East Orange, N. J. Motor controlled by starting bar and a correction key.

1,136,194. Device for Motion-Picture Printing. A. Wolfsohn, assignor to Motion Picture Appliance Corporation, New York, N. Y. Electrically operated film-printing machine.



No. 1,136,239.—Cord Operation of Push-Button Socket.

1,136,195. System of Motor Control. E. C. Woodruff, State College, Pa. Master controller governs electromagnetic switches with interlocks.

1,136,199. Trolley-Wheel Mount. R. Zawerics, Bentleyville, Pa. Harp is flexibly mounted.

1,136,200. Antifriction Bearing for Trolley Wheels. H. C. Adam, Hamilton, Ont., Canada, assignor of one-half to J. C. Adam. Ball bearing.

1,136,211. Boiler-Cut-Off System. G. W. Collin, Bridgeport, Conn. Includes electrically operated valves.

1,136,215. Magnetic Separator. M. Dings and R. A. Manegold, assignors to Dings Electro-Magnetic Separator Co., Milwaukee, Wis. Has a set of polar projections with exposed annular peripheral flanges and electromagnet windings between the projections.

1,136,227. Ozonator. L. Goldberg, Indianapolis, Ind. An electrode inside and one outside of a dielectric tube.

1,136,233. Metal-Working Switch. A. C. Johnson, Chicago, Ill., assignor to Production Meter Co. Vibration of machine by each piece worked closes circuit of production-recording meter.

1,136,239. Attachment for Electric-Switch Devices. C. J. Klein, assignor to Cutler-Hammer Mfg. Co., Milwaukee, Wis. Push-button lamp-socket switch can be operated by a pull cord. (See cut.)

1,136,240. Electric Switch. C. J. Klein, assignor to Cutler-Hammer Mfg. Co. Push-button lamp-socket switch.

1,136,246. Electric Locomotive with Cable-Reeling Mechanism. N. D. Levin, assignor to Jeffrey Mfg. Co., Columbus, O. Motor drives reel through sheaves.

1,136,275. Press for Making Glass Insulators. F. N. Roehrich, Brooklyn, N. Y., assignor to Brookfield Glass Co. Has screw plunger shaft.

1,136,279. Power-Transmitting Device. M. L. Severy, assignor to Severy Mfg. Co., Boston, Mass. Includes electromagnetic clutches and control therefor.

1,136,283 and 1,136,284. Mouthpiece-Protector for Telephone Transmitters. C. T. Smith, Newark, N. J. Cap sections covering the mouthpiece are actuated by movement of switch-hook.

1,136,312. Thermostatic Control for Electric Motors. D. P. Cartwright, assignor to Frigifax Mfg. Co., La Fayette, Ind. Includes a set of beams governing the switch contacts.

1,136,314. Circuit-Closer for Trolley Signal Systems. R. Y. Cheatham, St. Matthews, Ky. Pivoted arm on trolley ear closes circuit when trolley wheel passes in one direction.

1,136,324. Switch Box. C. A. Erichson, assignor to Yale & Towne Mfg. Co., Stamford, Conn. Locking switch.

1,136,337. Selective Signaling System. R. N. Hill, assignor to Western Electric Co. For telephone train dispatching.

1,136,347. Telephone-Exchange Switchboard. C. O'D. Lee, Jr., assignor to C. O'D. Lee, Sr., Baltimore, Md. Multiple board and an auxiliary board for answering signals only.

1,136,350. Electrically Driven Clock and Other Electrically Driven Running Mechanism. R. M. Lowne, Catford, England. Includes pursued and pursuing electric contacts mounted so as to move in the same circular path.

1,136,355. Musical Device. E. S. Mayland, New York, N. Y. Suspended tubular bell with electromagnetic striking hammer.

1,136,365. Electric Water-Heater. C. H. Quinlan, Amsterdam, N. Y. Casing screwed to faucet contains concentric cylinders with heating coil about inner one.

1,136,373. Illuminating Device. A. Sundh, Hastings-upon-Hudson, N. Y. Hollow knob contains a battery and lamp surrounded by conical glass shield.

1,136,383. Case for Incandescent-Electric-Lamp Sockets. A. Weber, Sr., assignor to Weber Electric Co., Schenectady, N. Y. Interlocked connection of cap and shell.

1,136,384. Tubular Conductor for Incandescent Electric Lamps. G. Weissmann, assignor to A. B. Heine, New York, N. Y. Concentric conductor for signs or decorative lighting has threaded socket for lamps in its outer shell and axial wire engaging center contacts of lamps. (See cut.)

1,136,404. Headlight. F. Buchanan, Syracuse, N. Y. Has a pair of sockets for a double-ended incandescent lamp.

1,136,405. Control Mechanism for Electric Motors. J. Buckley, assignor to A. Sommer, Boston, Mass. Electrically operated advertising device.

1,136,406. Water System. J. W. Butts, Atlanta, Ga. Turning of faucet operates circuit-closer.

1,136,407. Thermal Circuit-Closure. J. Carrigan, Seattle, Wash. Needle closes alarm circuit.

1,136,424. Electrolytic Process for the Extraction of Copper. N. V. Hybinette, Christiania, Norway. Includes several electrolytic steps.

1,136,433. Transposition Device for Electric Lines. G. W. Neel, Dublin, Tex. Tubular metal crossarm with ends bent in reverse directions and containing transposition wire.

1,136,449. Microphone. C. W. Underwood, Crowley, La., assignor of one-half to W. M. Egan. Includes compressing and agitating blades actuated by the vibrating member.

1,136,464. Engine-Starter. G. G. Chute and C. A. Groat, Portland, Ore. Motor-driven and electrically remote-controlled.

1,136,472. Knife-Blade Switch. G. E. Linton, assignor to F. C. Montgomery, Worcester, Mass. Special contact-blade construction.

1,136,477. Transmitting Apparatus for Use in Wireless Telegraphy and Telephony. G. Marconi, assignor to Marconi Wireless Telegraph Co. of America, New York, N. Y. Provides a number of condensers in parallel, means for charging them in opposite directions alternately and for discharging them in regular succession through inductive resistances.

1,136,483. Process and Apparatus for Treating Ores. L. E. Porter, Los Angeles, Cal., assignor of one-half to H. E. Stock. Electrolytic cell and agitator with porous diaphragms dividing the vessel into a series of anode and cathode compartments.

1,136,508. Call-Distributing System. H. P. Clausen, assignor to Western Electric Co. Switch for automatically connecting the incoming telephone call to an idle outgoing trunk.

1,136,521. Typographical Composing-Machine. M. J. Geel, Vienna, Austria-Hungary, assignor to Mergenthaler Linotype Co. Normally open circuit containing lamp is closed by a matrix passing through the distributing mechanism.

1,136,533. Winding Device for Drop-Lights. C. V. Johnson, assignor to Indispensable Mfg. Co., Goldfield, Nev. Drum contains contact brushes, cord reel and brake.

1,136,566. Gyrocompass. H. Usener, Kiel, Germany. Motor-driven gyroscope with electric regulating device.

1,136,567. Automatic Train-Stop. F. K. Wade, Paterson, N. J., assignor of one-half to R. C. Denny. Electromagnetic control for air-brake valve.

1,136,574. Trolley-Wheel Mount. J. Wilder, Augusta, Me. Flexible mounting.

1,136,580. Convertible Lamp. C. Bergener, assignor to C. T. Ham Mfg. Co., Rochester, N. Y. Oil or electric lantern.

1,136,593. Arc Lamp. R. Fleming and C. A. B. Halvorson, Jr., assignors to General Electric Co. Has self-contained compensator for connection to constant-current system.

1,136,601. Guard. T. B. Harris, Jacksonville, Fla. Electric alarm for locking mechanism.

1,136,602. Program Clock. C. O. Heon, assignor to Heon Reminder Clock Co., Janesville, Wis. Has a number of electric spaced contacts movable into and out of position for engagement by the hand.

1,136,621. Motor-Controller. W. M. Shallcross, assignor to Cutler-Hammer Mfg. Co. Series-parallel controller for two series motors can also connect for dynamic braking.

1,136,639. Circuit-Controller. P. H. Zimmer, assignor to Cutler-Hammer Mfg. Co. Motor starting box with two interconnected arms.

1,136,646. Demagnetization of Tools Working Magnetically Mounted Work Pieces. J. Bing, Eisenlach, Germany. Process of preventing shavings from adhering to the tool consists in constantly exposing the tool to an alternating magnetic field.

1,136,657. Overload Protective Device. W. E. Date, assignor to Cutler-Hammer Mfg. Co. Motor circuit-breaker with dashpot to check opening while starting motor.

1,136,667. Method and Apparatus for Sanding Rails. J. V. Geraghty, New York, N. Y. Electromagnetic method of sanding rails to prevent and remove corrugations therein.

1,136,668. Motor-Controller. M. M. Goldenstein, assignor to Cutler-Hammer Mfg.

No. 1,136,384.—Concentric Conductor for Display Lighting.

Co. Includes solenoid-operated reciprocating contact bridge for rheostat.

1,136,680. Electric Switch. C. J. Klein, assignor to Cutler-Hammer Mfg. Co. Reciprocating pushbar switch for lamp socket.

1,136,681. Switching Socket or Connector. G. C. Knauff, Chicago, Ill. Rotation of plug in socket connector opens and closes circuit.

1,136,683. Wireless Receiving Apparatus. J. S. Leach, Brooklyn, N. Y. Telephone receiver with special adjustment of magnet coil with respect to diaphragm.

1,136,684. Induction Light System. J. Ledwinka, assignor to Edward G. Budd Mfg. Co., Philadelphia, Pa. Vacuum tube with axial filament forms closed secondary of transformer.

1,136,687. Muffler Attachment for Telephones. J. Litt, Philadelphia, Pa. Air cell and shaped mouthpiece attached to ordinary mouthpiece of transmitter.

1,136,688. Starting Device for Internal-Combustion Engines. W. D. Lutz, Allendaleborough, N. J. Electric starter.

1,136,737. Electric Switch. G. R. Thomas, assignor to Perkins Electric Switch Mfg. Co., Bridgeport, Conn. Push-button switch with wire terminals upstanding from base.

1,136,739. Phonograph. G. S. Tiffany, Summit, N. J. The bottom of the rotating table carries armature plates that may be attracted by electromagnets as a brake.

1,136,741. Border-Cutting Machine. W. H. Waldron, assignor to John Waldron Co., New Brunswick, N. J. Includes an electrically controlled brake.

1,136,750. Electric Train Signaling and Controlling System. A. J. Allard, Richmond, Va., assignor of one-third to T. F. Green and one-third to D. R. Creecy, Jr. Block system with special contact rails.

1,136,751. Electric Train Signaling and Controlling System. A. J. Allard, Richmond, Va. Modification of above.

1,136,779. Suspension Device of Motors on Tramway or Railroad Motor-Cars. C. Delmez, Antwerp, Belgium. Special truck construction.

1,136,781. Bell-Ringing Device. H. D. Elliott, Skamokawa, Wash. Includes ratchet contact.

1,136,789. Testing Device for Accumulators. O. P. Fritchle, assignor to Fritchle Automobile & Battery Co., Denver, Colo. Hydrostatic hydrometer with one tube showing constant specific gravity and the other variable specific gravity of cell electrolyte.

1,136,791. Automatic Train-Stopping Apparatus. S. K. Ghosh, Seattle, Wash. Combined electric signal and means of cutting off propelling power.

1,136,803. Trolley-Replacer. G. D. Hoppes, Springfield, O. On each side of the wheel is a conical spirally grooved guide wheel.

1,136,804. Signal Lamp. H. E. Horning and J. L. Subik, Johnstown, N. Y. Automobile signal casing has two compartments with a lamp in each.

1,136,810. Device for the Comparison of Current, Tension, and Power by Self-Acting Resistances. M. Kallmann; P. Kallmann, Berlin, Germany, administratrix of said M. Kallmann, deceased. Includes a three-wire system with neutral, a meter with main coil in one of the outer leads, and a set of resistances of zero and high temperature-coefficient.

1,136,814. Automatic Direction-Indicator. N. W. Kleinman, Brooklyn, N. Y. Electrically operated rear lamp signals for automobiles.

1,136,838. Selective Call Device. H. O. Rugh, Sandwich, Ill., assignor to Hall Switch & Signal Co. For train signaling or dispatching system.

1,136,842. Cloth-Cutting Machine. M. Siegel, New York, N. Y., assignor of one-half to S. Solomon. Motor-driven.

1,136,845. Electric Vaporizer. C. G. Tate, assignor to United Motor Equipment Co., Chicago, Ill. Exposed resistance unit in carbufeter chamber.

1,136,847. Trolley. F. Thornton, Huntington, W. Va. Special bearings and leaf contact springs.

1,136,873. Sign or Advertising Device. F. Z. Hanscom, Chicago, Ill. Motor-driven oppositely rotating illuminated bands.

1,136,907. Armature for Electrical Machines. R. M. Warren, assignor to Sumter Electrical Co., Sumter, S. C. The core has H-shaped laminas.

1,136,912. Telephone Repeater System. T. G. Martin, assignor to Automatic Electric Co., Chicago, Ill. Automatic two-way trunking system with a repeater at one end of each trunk.

Patents Expired.

The following United States electrical patents expired on April 26, 1915:

602,872. Process of Producing Chemical Compounds by Electrolysis. J. W. Richards and C. W. Roepper, Bethlehem, Pa.

602,873. Process of Electrolytically Manufacturing Metallic Sulphides. J. W. Richards and C. W. Roepper.

602,895. Electrical Selector. L. W. Crofoot and F. E. Granger, Aberdeen, S. D.

602,920 and 602,921. Alternating-Current Induction Motor. C. P. Steinmetz, Schenectady, N. Y.

602,922. Electric Arc Lamp. E. Thomson, Swampscott, Mass.

602,923. Trolley. J. E. Wells, Syracuse, N. Y.

602,925. System of Electric Metering. H. C. Wirt, Schenectady, N. Y.

602,950. Electric Massage Appliance. F. J. S. Lau, Kansas City, Mo.

602,953. Electric Luminous Alphabet and Board for Same. D. W. Moore, Newark, N. J.

602,963. Distribution of Electric Currents. E. Thomson, Lynn, Mass.

603,027. Rheostat. R. W. Ney, New Rochelle, N. Y.

603,041. Electrostatic Generating Machine. A. H. Hoyt, Penacook, N. H.

603,042. Hinge Connection for Electrical Measuring Instruments. A. H. Hoyt.

603,056. Incandescent Electric Lamp. M. W. Dewey, Syracuse, N. Y.

603,058. Electrical Retort. H. Eldridge, D. T. Clark and S. Blum, Galveston, Tex.

603,060. Electric Railway. C. F. Holtmann and C. Bergmann, Pittsburgh, Pa.

603,061. Device for Turning-Off Commutators of Dynamos or Motors. W. H. Jordan, Brooklyn, N. Y.

603,063. Rheostat. A. W. Leonard, East Orange, N. J.

603,069. Electric Cable. N. G. Warth, Indianapolis, Ind.

603,112. Electric Lamp. D. Misell, New York, N. Y.

603,184. Electropneumatic Piano Player. F. R. Goolman, Los Angeles, Cal.

603,198. Electrically Propelled Vehicle. H. G. Morris and P. G. Salom, Philadelphia.

603,229. Storage Battery. E. A. Barber, Watertown, N. Y.

Electric Vehicle Section

Possible Electric-Vehicle Market and Income to Central Stations in Medium-Sized Cities.

A comprehensive analysis of the status of the electric passenger-vehicle industry, presented by S. G. Thompson, of the Public Service Electric Company, Newark, N. J., before a recent meeting of the Electric Vehicle Association of America, refutes the statement that only in the larger communities does the electric vehicle find its field of application. In fact, there are but 72 cities in the United States whose population exceeds 75,000 and of these only five have over 600,000 inhabitants, while a comparison of two cities where the vehicle development has extended over a period sufficiently long to establish these machines shows that the ratio of electric passenger vehicles used to the population is materially greater in the smaller community. In Chicago, with a population of about 2,250,000, there is in use one machine for every 750 inhabitants, while in Cleveland, with but 25 per cent of that population, there is one machine for every 340 inhabitants.

One explanation for this condition is that in the larger city, apartment-house dwellers predominate, who through force of circumstances must depend upon public garages for the care of their machines, while in the smaller cities private garaging is more generally possible. As a matter of fact, the real business in the electric passenger vehicle is to be found among that class of buyers with whom depreciation and economy of operation are important considerations, and it is just that difference between public garage charges and the expense of maintaining a car "on the premises" which deters a majority from purchasing. In other words, the free use of private garages with proper intermittent oversight by experts is essential to an active business, and it is in the smaller communities that the possibilities for such practice exist. Therefore, a wide field of application for the electric passenger vehicle is to be found in the smaller communities, which fact has been amply demonstrated in the 13 cities of less than 600,000 inhabitants where the central stations have energetically promoted the use of these machines, and incidentally materially benefited thereby.

No less an authority than Dr. Steinmetz predicts that the future of automobiling belongs to the electric vehicle. The time has already come which witnesses the beginning of the change of the automobile from a sporting proposition to a business proposition—from a sporting pleasure vehicle to a business vehicle—not used for the pleasure of going itself, but for going to some place with a definite object. For this purpose, the electric automobile may be and is capable of doing all that the gasoline car can do. While the possibility of long-distance touring is a temporary advantage of the gasoline machine, when the automobile has come to be an every-day business proposition and not a sporting device, this will be a matter of secondary importance. When the first enthusiasm for automobiling as the greatest of all sports will have somewhat dwindled away, the electric vehicle will predominate because it is within the reach of the average man from the viewpoint of economy of operation, it being a cheap and convenient means of locomotion.

The value of an electric passenger vehicle to the central station from the point of revenue equals that of an average residence; $100 per year per machine is a fair estimate of the amount of money to be derived from this class of business, while the load is particularly valuable as being of an off-peak character and requiring no additional investment for power-house equipment and line extensions. Based on the conditions as existing in Cleveland, the possible vehicle market and income in cities varying from 75,000 to 600,000 inhabitants may be calculated from Table I herewith.

This table is not intended to be indicative of the maximum business to be obtained in such medium-sized cities, but of the conditions which would exist if developments progressed to a point on a par with the present conditions in Cleveland. As it requires an annual increase of but 25 per cent in the volume of sales of electric vehicles over the previous year to produce double the number of machines in operation in a five-year period, it is very evident that the figures given in the

TABLE I.—POSSIBLE VEHICLE MARKET AND INCOME TO CENTRAL STATIONS IN MEDIUM-SIZED CITIES.[1]

Population	Number of Cities	Number of Machines	Annual Income at $100 per Vehicle	Will Pay 4% Interest on
75,000 to 100,000	22	220	$22,000	$550,000
100,000 to 125,000	10	300	30,000	750,000
125,000 to 150,000	99	370	37,000	925,000
150,000 to 200,000	3	441	44,000	1,102,000
200,000 to 250,000	9	600	60,000	1,500,000
250,000 to 300,000	1	735	73,500	1,837,500
300,000 to 350,000	5	882	88,200	2,205,000
350,000 to 400,000	2	1,029	102,900	2,572,500
400,000 to 500,000	3	1,177	117,700	2,942,500
500,000 to 600,000	3	1,471	147,100	3,677,500
600,000 and over	5	1,765	176,500	4,412,500

1 Based on minimum population given.

TABLE II.—ELECTRIC-VEHICLE CENSUS IN TWO MEDIUM-SIZED CITIES.

Business	Population 350,000 Number of Firms	Population 350,000 Number of Vehicles Required	Population 260,000 Number of Firms	Population 260,000 Number of Vehicles Required
Beef packers	4	24	8	67
Bakers	18	111	6	40
Brewers and bottlers	14	159	4	17
Building material	3	5	....	.....
Coal and wood	7	53	15	162
Department stores	6	154	3	66
Fertilizer manufacturers	1	10	....	.....
Flour, feed and grain	7	74	1	12
Food products	....	.....	10	51
Furniture dealers	5	8	6	10
Grocers	9	38	10	20
Hardware supplies	8	16	....	.....
Ice-cream manufacturers	1	27	2	13
Livery stables	3	49	2	7
Lumber	8	32	7	26
Liquors and mineral waters	....	.....	2	23
Laundries	9	21	5	27
Masons' materials	8	38	....	.....
Milk dealers	2	41	6	90
Oils and paints	6	33	6	27
Storage and trucking	11	81	13	82
Miscellaneous	23	123	31	171
Total	153	1097	137	911
Ratio of vehicles to population		1 to 319		1 to 285

tabulation do not define the limitations of the business, particularly as the medium-priced electric passenger car is now rapidly developing an entirely new class of buyers, and the successful production of a low-priced machine is already established.

Electric Commercial Vehicle. — It may be stated broadly that the field of application for the electric commercial vehicle is *the service wherein horses are now employed.* Naturally a large volume of business in this direction is to be obtained from the largest cities. However, in communities of from 200,000 to 350,000 inhabitants the possible vehicle market is considerably greater than is generally realized, particularly as the development of low-priced machines designed to replace the single-horse unit is opening up an extensive market among those who may be classed as doing "a neighborhood business."

As indicating the possible market in such cities, the tabulation given in Table II is taken from the census of two cities of approximately 350,000 and 260,000 inhabitants. In compiling this census small tradesmen and business houses of low commercial rating whose horse-vehicle equipment was not sufficient to warrant its replacement by electric machines were eliminated, so that the census may be taken as a fair indication of the probable market in communities of the above sizes.

TABLE III.—CONSUMPTION AND INCOME CHARACTERISTICS FOR POWER WAGONS.

	Capacity of Vehicle (in Pounds).					
	700	1,000	2,000	4,000	7,000	10,000
K.W. capacity (input[1])	11.3	15.1	17.7	23.7	30.5	35.6
Annual K.W.H. input (312 days)	3,526	4,711	5,522	7,394	9,516	11,107
Annual income at 3 cents per K.W.H.	$105.78	$141.33	$165.66	$221.82	$285.48	$333.21
H.P. connected	4.4	4.4	5.3	5.3	7.2	7.2
Income per H.P. of connected load	$24.00	$32.00	$31.30	$41.90	$39.40	$46.30
Average kilowatt-hour input for all sizes of vehicles						6,963
Average annual income for all sizes of vehicles						$208.88

1 Based on standard lead battery equipment.

Considering the cities for which the above census was compiled, the value of the power-vehicle load based on the average energy consumption for all sizes of vehicles (see Table III) would be as follows:

Population	K.W.H. Consumption	Income at 3 cents per K.W.H.
260,000	6,343,293	$190,298.79
350,000	7,638,411	229,152.33

In Table III are shown the K. W. H. consumption for the various sizes of commercial vehicles, connected load, and income per H. P. of connected load, which latter it will be observed compares very favorably with other branches of power business.

Lincoln Highway Association to Save Vehicle Tourists Freight Charges.

Thousands of cars are going to drive into Oakland this summer from every part of the United States, over the Lincoln Highway. The city's facilities for the handling of the vehicles will be strained to the utmost. The greater proportion of these tourists, many of whom will have covered thousands of miles in reaching the coast, will prefer to return home by rail, shipping their cars.

Now this is a pretty expensive proposition if handled individually. The freight rate on automobiles from Pacific coast points to Boston, Philadelphia, New York and other eastern cities is $7.40 per hundred pounds, which makes a 3,000 pound car cost $222.00 to return. This is if the car is handled alone. If shipped in carload lots, however, the rate is cut about in half. For instance, the rate to Chicago on individual shipment is $6.80 per hundred; if in carload shipment the rate is $3.00. Therefore it is of immense advantage to tourists to group or pool their cars for shipment to common points.

The Lincoln Highway Association, pursuing its policy of aiding the tourist in every way possible, has made arrangements for the handling of this important problem and has appointed agents on the cost, who will take cars at Oakland and handle all the detail of arranging for shipment, assembling into carloads for different points, attending to insurance while en route, etc.

After paying a slight charge for this service the tourist still saves from 25 to 50 per cent of what it would cost him to ship his car individually, the amount of saving depending on the point of destination, the number of other cars going to the same point and the weight of the car.

Co-operative Battery Service to Electric Vehicle Users.

The Boston Edison Company, the General Vehicle Company and the Electric Storage Battery Company have entered into an arrangement by which battery service will be provided to purchasers of G. V. trucks in Boston territory. The Edison Company will purchase batteries required by customers operating new vehicles, charge them, and inspect and garage vehicles at a fixed price per mile of service operated.

Sufficient batteries will be kept on hand to enable a change of motive power at a moment's notice. A garage on Atlantic Avenue, Boston, will be headquarters for the service, and where truck owners can garage their cars here, they will have the advantages of charged batteries ready for immediate installation when the vehicles come in from their runs.

The garage will have a hydraulic lift and other apparatus to take care of the new system.

The plan is along similar lines to one in operation by the Hartford Electric Light Company, Hartford, Conn., which has resulted in the purchase of a large number of cars in that city. An important consideration, in connection with the plan, is that the purchaser of an electric wagon knows in advance just how much per mile his operating expenses of battery maintenance, charging and garaging will cost.

Chicago Vehicle Meeting.

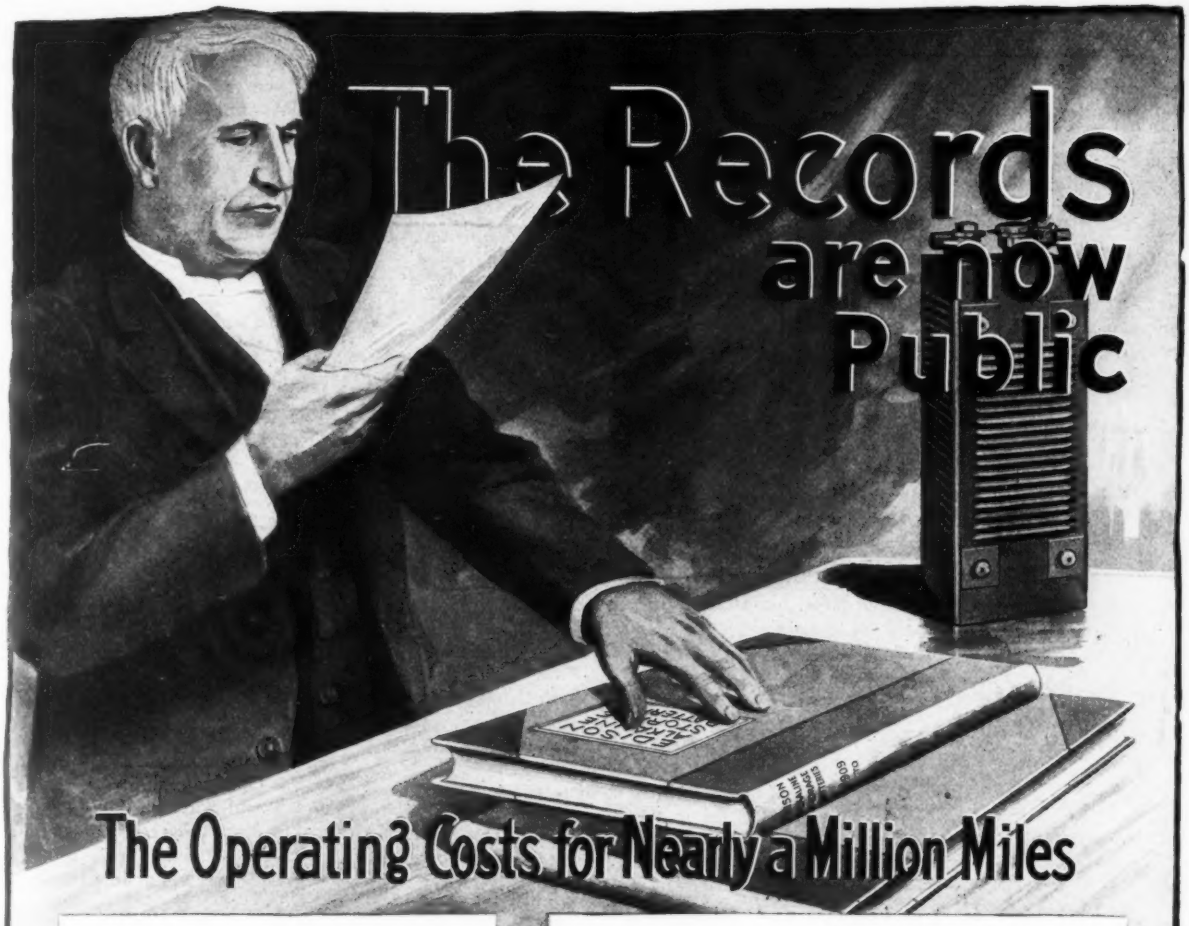
On April 22 a joint meeting was held in Chicago of the Electric Club, the Jovian League, and the Chicago Section of the Electric Vehicle Association of America. An address was made by John F. Gilchrist, president of the last named association, on the subject of "Electric Vehicles." This was followed by motion pictures, which told their own lessons in regard to electric-vehicle use.

A report was made by P. B. Woodworth, of The Electric Club, for the Committee on a Civilian Military Reserve. This committee has been in communication with the War Department in regard to this subject, and finds that the latter is not yet ready to enroll civilians in an engineering corps, but has the matter under consideration and suggests that the best means for training engineers for military service is through the National Guard of the state.

Announcement was made of the resignation of Vice-President W. D. Ray, who is leaving Chicago, and the president appointed Victor H. Tousley as temporary vice-president until a successor is regularly appointed.

Announcement was made of a theater party of Jovians, to take place on the evening of May 11. Tickets can be procured from Perry Boole.

Announcement was also made by Secretary McCall, of the Vehicle Association, regarding a Prosperity Day parade on April 26. This parade was duly held upon the day mentioned, and electric vehicles to the number of 275 occupied a prominent position in the line. This event served as an inaugural parade at the installation of the new mayor of Chicago, William Hale Thompson, in office. The Commonwealth Edison Company had in line a float, as well as 20 trucks and a passenger car. The Fashion Garage furnished a float, and many manufacturers of electric vehicles were represented.

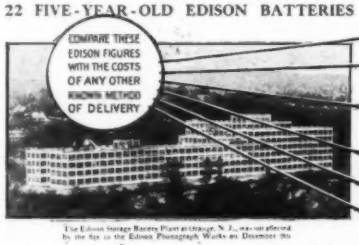


The Operating Costs for Nearly a Million Miles

I CLAIMED that the **New Alkaline Storage Battery** would make the Electric Vehicle the cheapest means of Street Transportation, but I had only my private tests to satisfy me. Today thousands of Edison Batteries in thousands of **Trucks** and Delivery Wagons are making Operating Records that are easily investigated by all. After the four or five years of hard service that many of these vehicles have had, is it possible to deny that my claim is proved?

Thomas A. Edison

HERE IS ONE RECORD—A REPORT—ON 22 FIVE-YEAR-OLD EDISON BATTERIES



The Edison Storage Battery Plant at Orange, N. J., as viewed by the Sun in the Edison Phonograph Works on December 9th

Write for Bulletins on the use of **Edison Batteries** for Lighting Country Houses, Ignition and Lighting of Gasoline Cars, Yacht Lighting, Railway Train Lighting and Signaling, Telephone, Telegraph and Wireless *and High-priced or Low-priced Passenger Electrics.*

Edison Storage Battery Company
Orange, New Jersey

Distributors in { New York Chicago Boston Cleveland Washington / San Francisco Los Angeles Portland, Oregon Seattle

ADAMS EXPRESS COMPANY

242 WEST 47TH STREET

MOTOR VEHICLE DEPARTMENT
GEORGE STEVENS
SUPERINTENDENT

NEW YORK, December 7th 1914

Edison Storage Battery Company,
Orange, N. J.

Attention of
Mr. A. Bachman,
V.P.& Genl Mngr.

Gentlemen:-

Thank you for consenting to extend from five to six years the conditions of your guarantee regarding renewal of positive plates.

The average operating cost per battery per month of the twenty-two trucks at Indianapolis, equipped with Edison Batteries in November 1909 and averaging about 660 miles per month, is as follows:-

YEAR	BATTERY MAINTENANCE (Refilling, new solution, watering, cleaning, all repairs, inspection, etc.)		CURRENT (Purchased by meter)	TOTAL
	Material	Labor		
1910	$3.47	$4.10	$10.05	$17.62
1911	3.41	4.10	8.93	16.44
1912	3.41	4.10	9.90	17.41
1913	2.86	4.10	8.17	15.13
1914(to Oct.31)	3.11	4.10	9.50	16.17

The average total operating cost per battery per month has, therefore, been $16.55 for a period of five years. In this time the average mileage per truck was about 40,000, which reduces the operating cost to 4.02¢ per mile. The batteries are still in service.

Yours very truly,

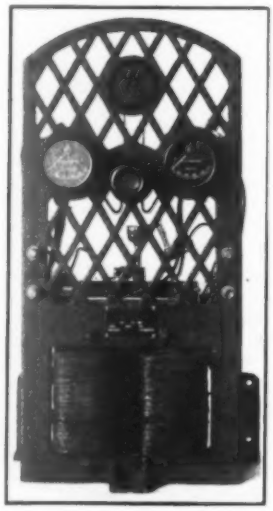
GS•HW

Superintendent.

The Ward Special—A Low-Cost Electric Delivery Wagon.

For some time central-station men, particularly in the larger cities, have felt that opportunities for great development in the use of electric commercial vehicles were slipping by, because of the lack of low-cost but high-grade vehicles adapted for general city delivery service with merchandise capacities of 700 to 1,000 pounds. It was believed that the electric vehicle was peculiarly suited to such urban delivery service, making many stops with comparatively small parcels and averaging some 30 miles a day over fairly well paved streets.

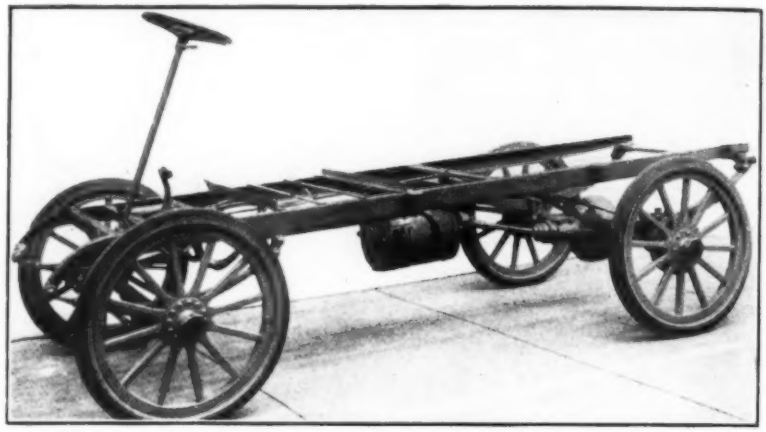
Responding to this demand, the Ward Motor Vehicle Company, Mount Vernon, N. Y., brought out last fall what has been termed the "Ward Special," a well built and well equipped wagon with



Low-Cost Rectifier and Charging Outfit.

a rated merchandise load capacity of 750 pounds, which sells at the low price of $875. Many of these vehicles have been placed in service in the last few months and have given a very good account of themselves. A canvass and analysis of delivery-service conditions in New York City has shown that it costs about $30 a month to stable, feed and care for the average single horse and wagon outfit. Compared to this it has been found that the Ward Special can be stored, washed and charged for about $20 a month.

The general view of the wagon herewith shows that while it is built primarily on service lines, it is well proportioned and neatly finished. The chassis construction is simple, but of ample strength for the requirements of the service. Steel channels and angle bars constitute the main framing. The axles are of drop-forged steel with Timken bearings; the rear axle has a pressed-steel housing for the differential and helical gears. Semi-elliptic springs are provided on both front and rear axles. Wheel steering of the minimum-lost-motion type is used. Twelve-spoke artillery wheels are provided with 32 by 2.5 inch Firestone tires on side-wire rims. There



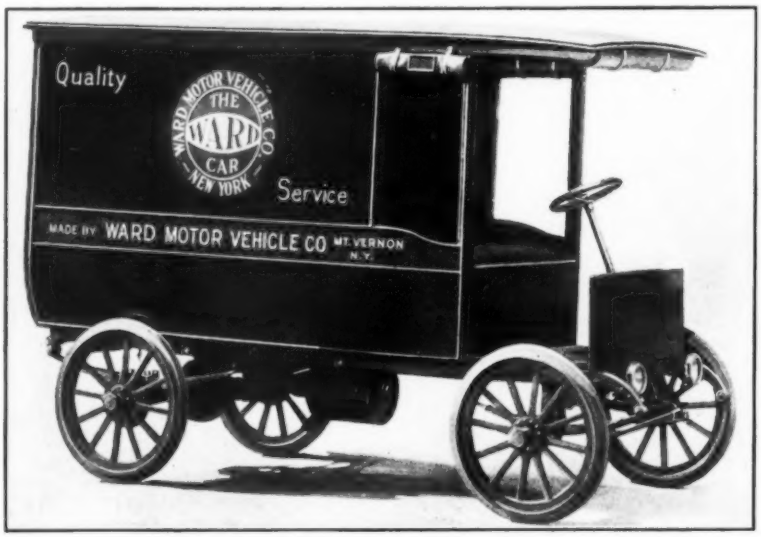
Chassis and Transmission Ward Special Low-Cost Electric Delivery Wagon.

are two brakes expanding into the rear hubs.

By use of steel panels a light-weight and strong body is obtained. It is neatly painted, chiefly in shades of green.

The motor is a Westinghouse heavy-duty, series-wound machine driving through universal couplings the propelling shaft and transmission gearing. The controller is of the continuous-torque type and has four speeds ahead and two reverse. Battery power is furnished by a 42-cell Philadelphia storage battery with nine plates per cell; Ironclad-Exide or Edison batteries are supplied at somewhat increased price. The rated speed is 10 miles per hour and the radius of action 35 to 45 miles per charge under average conditions.

For use with the Ward Special in alternating-current districts, a simple form of Westinghouse rectifier outfit has been developed for charging the battery from 60-cycle, 220-volt, single-phase circuits. This equipment is so adjusted as to give an automatically tapering charge to the battery. Charging procedure consists merely in inserting the charging plug, closing the line switch and rocking the mercury-arc bulb to start the rectifying action. This charging panel is furnished with or without instruments at low cost.



The Ward Special Low-Cost Electric Delivery Wagon.

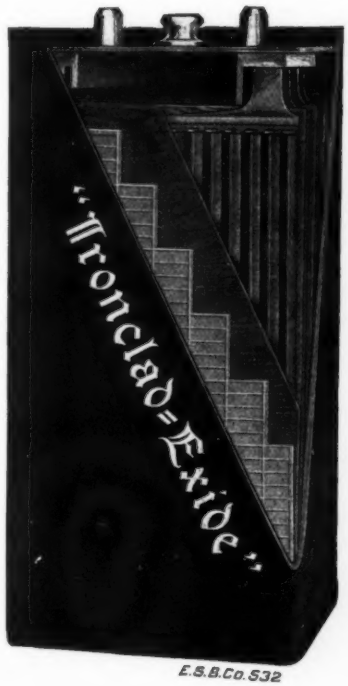
From the foregoing brief description it is evident that the entire vehicle equipment is of good grade, and that the Ward Special is a low-cost but not "cheap" wagon. Reduction in construction cost has been secured by a careful selection of materials and by production on a large scale.

Through arrangements made by the

The "PEP" in the "Ironclad-Exide" Battery

"PEP." It means—"energy," "snap," "full of life," "always on the job," "ability to do things." Think of Eddie Collins, then define it for yourself.

What's the use of using a vehicle battery that may answer your ordinary requirements only and then does not stand up when it comes to emergencies.



The "Ironclad-Exide" Battery has the "Pep" that gives results—whether in pleasure or commercial "Electrics." It has "snap" and "vim"—a resourcefulness that meets emergencies. It's always on the job. It's always ready to give up whatever it has. Technically, it has the ability to discharge at high rates and maintain speed. And, furthermore, it is the battery of long life.

The "Ironclad-Exide" Battery is a business battery that appeals to business men. It's a live-wire proposition with plenty of "Pep."

These statements become very real when you read the new "Ironclad-Exide" testimonial book. Our nearest office will send you a copy upon request.

THE ELECTRIC STORAGE BATTERY CO.

Manufacturer of

The "Chloride Accumulator", The "Tudor Accumulator"

The "Exide", "Hycap-Exide", "Thin-Exide" and "Ironclad-Exide" Batteries

New York Boston Chicago Washington **PHILADELPHIA, PA.** Denver San Francisco Seattle St. Louis
Cleveland Atlanta Pittsburgh Detroit **1888-1915** Rochester Los Angeles Toronto

13 "Exide" Depots

Ward Motor Vehicle Company with the publishers of "The Electric Vehicle Handbook," by Cushing and Smith, a special edition of this valuable book has been issued, in which there is a supplementary chapter devoted to the "Ward Special." It describes the mechanical and electrical equipment of the vehicle, and gives valuable instructions regarding its proper care. A copy of this edition is furnished to each purchaser of this delivery wagon by the manufacturer.

Mr. Ward Comments on the Low-Cost Efficient Electric.

In the discussion on electric vehicles, which formed the general topic for the second day of the recent Question Box convention of the New England Section, National Electric Light Association, and which was summarized in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of March 27, 1915, a prominent electric vehicle manufacturer said that he thought the time not yet at hand when a low-cost, efficient electric can be produced. This remark has drawn forth the following comments from Charles A. Ward, secretary-treasurer of the Ward Motor Vehicle Company:

"We exceedingly regret the statement appearing on page 600 of your March 27th issue, that the time has not yet come when an efficient, low-cost electric could be produced. We have been actually manufacturing such a vehicle for over five months past, having announced it at the Electrical Show in New York in October of last year.

"As to its efficiency in operation, we are pleased to refer you to the 30-day test, copy of which is given herewith, and concerning which we call your particuar attention to the excellent mileage for the current consumption involved, together with the excellent showing in the way of overload or excess capacity.

"You will aso be interested to learn that here in the metropolitan district we are offering a five-year maintenance guarantee, whereby the customer is absolutely assured that his average annual maintenance expense over the entire five-year period will *not exceed* the figure of $300 *annually*. This is based on an average daily mileage of 25 miles, and accordingly works out at the rate of 4 cents per car mile, maximum.

"Again, we express the regret that this statement, through no real fault of yours, should have appeared."

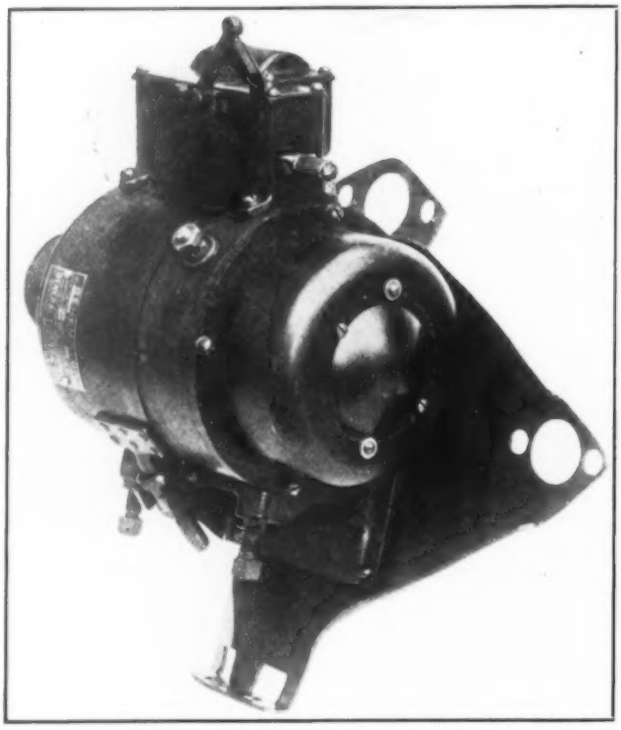
ANALYSIS OF PERFORMANCE FOR THIRTY WORKING DAYS OF WARD SPECIAL.

Days operated	30
Miles traveled	1,140.5
Kilowatt-hours used	319.5
Number of miles per kilowatt-hour	3.57
Greatest energy consumption for one day	13 K.W.H.
Smallest energy consumption for one day	10 K.W.H.
Average energy consumption for one day	10.65 K.W.H.
Shortest run	33.5 miles
Longest run	46.5 miles
Average run	38.01 miles
Greatest merchandise load[1]	1,500 lbs.
Smallest merchandise load	500 lbs.
Average merchandise load[1]	1,000 lbs.
Current cost per car-mile at 3 cents per K.W.K	$0.008
Current cost per car-mile at 4 cents per K.W.H	.011
Current cost per car-mile at 5 cents per K.W.H	.014
Maintenance (maximum estimate), including repairs and renewal of all mechanical and electrical parts, including tires, battery, and painting of wagon, should not exceed per car-mile	.04

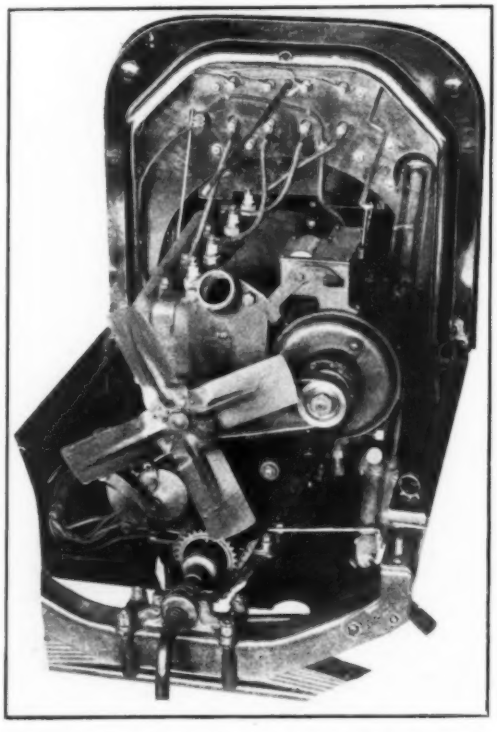
1 The rated merchandise load capacity of this car is 750 pounds. The above performance was therefore accomplished with an average overload of 250 pounds of merchandise and in no instance was the car run with less than 500 pounds of merchandise on the springs.

The Genemotor—New Self-Starting and Lighting System for Ford Cars.

A new self-starting and lighting system, known as the Genemotor system, has recently been designed and is now being manufactured by the General Electric Company, particularly for installation on Model T Ford automobiles, of which there are said to be over 600,000 in use at the present time.



Genemotor Ready for Installation.



Genemotor Installed as Part of Automobile Equipment.

The principal mechanism of the system consists of a single electrical unit, wound for 12 volts, which operates as a generator or a motor, as the case may be, and the necessary accessories for attaching to and operating on the Ford car. In addition, a six-cell, 42 ampere-hour battery, especially manufactured by the United States Light & Heating Company for use with this equipment, is included. The outfit thus combines the functions of a generator,

Books on Electric Vehicles

"The Electric Vehicle Hand-Book"

By H. C. Cushing, Jr. and Frank W. Smith

Fellow Am. Inst. Elec. Engrs. Publisher of "The Central Station," the official organ of the Electric Vehicle Association of America.

President Electric Vehicle Association of America and Vice Pres. United Electric Light & Power Co., New York.

362 Pages, Fully Illustrated, Flexible Leather Cover, Pocket Size. **Price, $2.00.**

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II.—Lead Storage Batteries; Descriptive Lead Batteries; Charge and Discharge Rates; Care of Storage Batteries.
III.—Care of Lead Storage Batteries; Assembling and Putting New Batteries into Condition; Charging; Charging Overnight; Emergency Charging; Inspection; Electrolyte; Cadmium Readings; Lead Burning.
IV.—Commercial Types of Lead Storage Batteries.
V.—Alkaline Storage Batteries; Description and Care.
VI.—Charging Apparatus and Charging Stations; Alternating Current Apparatus; Isolated Plants.
VII.—Measuring Instruments, Electrical and Mechanical.
VIII.—Wheels, Rims and Tires; Their Care.
IX.—The Motor Construction and Care.
X.—The Controller, Construction and Care.
XI.—The Chassis, Its Components, Their Upkeep.
XII.—Association and Publications Identified With the Development of the Electric Vehicle.
XIII.—Comparative Cost Data.

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Revised and Enlarged 1911 Edition. 16mo, over 650 Pages and over 320 Illustrations. Full Leather Limp, Round Corners, Red Edges. Price $2.00.

The automobile hand book is a work of practical information for the use of owners, operators and automobile mechanics, giving full and concise information on all questions relating to the construction, care and operation of gasoline and electric automobiles, including road troubles, motor troubles, carbureter troubles, ignition troubles, battery troubles, clutch troubles, starting troubles. With numerous tables, useful rules and formulas, wiring diagrams and over 320 illustrations.

Power transmission is thoroughly discussed, and the various systems of transmitting the power from the motor to the driving axle are analyzed and compared.

The perusal of this work for a few minutes when troubles occur, will often not only save time, money, and worry, but give greater confidence in the car, with regard to its going qualities on the road, when properly and intelligently cared for.

This is a brand new book from cover to cover—1911 Edition—and must not be confounded with any former editions of this popular work.

PRACTICAL AUTOMOBILE DICTIONARY. By S. KRAUSZ

English-French-German; French-English-German; German-French-English. With an introduction by C. J. Glidden. Twelve thousand technical terms and other words employed in connection with motor cars and motoring. For use in office, factory, repair shop and touring in foreign countries. 16mo. Leather. 129 pp. Price $2.00.

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A practical treatise on the theory, construction, operation, care, and management of all forms of automobiles. Seventh Edition, revised. 500 illustrations. 6x9. Cloth. 667 pp. Price $2.00.

The various theories and problems involved in the construction and operation of the prevailing types of motor road carriages have been stated as clearly as possible, in order that the involved situations may be readily comprehended by all readers. The fundamental principles of the several types of motor, particularly of the gasoline engine, which is the least understood of all, have been treated at considerable length, in order that the facts may be thoroughly comprehended in their new relations.

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A practical treatise on the construction of modern motor-cars, steam, petrol, electric and petrol-electric. Three volumes. Special Edition, enlarged. 1,260 illustrations. 8vo. Cloth. 1,300 pp. Price $10.00.

A very handsome set of instructive books brought up to date in the third volume containing many elaborate illustrations of cars now in use.

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GENERAL MOTORS COMPANY
TRUCKS

Boost Your Night Demand

By fostering the use of electric trucks in your community you are planting seeds that will bear fruit in the form of a profitable off-peak load. A five-ton truck is five times as great a consumer of electric current as the average city residence—and what is more important, the demand is greatest between midnight and 6 A. M. in the valley of your load.

Active interest on your part will add electric truck connections to your lines. We will welcome the opportunity to co-operate with you. Why not ask for details regarding our complete line of electric trucks and their adaptability to your territory. We build 8 capacities from 1,000 lbs. to 6 tons.

GENERAL MOTORS TRUCK CO

One of the Units of General Motors Company

PONTIAC, MICHIGAN

Direct Factory Branches: New York, Boston, Chicago, Philadelphia, St. Louis, Kansas City, San Francisco.

(6)

which furnishes the primary current that is stored for starting the car and operating the various lights, as well as those of a motor for spinning the engine in starting.

The Genemotor is fully inclosed, about 10 inches long overall, seven inches in diameter and weighs about 52 pounds. It is supported rigidly on the right-hand side of the Ford engine, viewed from the front, by a pressed-steel bracket secured at three points. This bracket can be attached without drilling or tapping any holes. The base of the bracket rests on the lower flange of the engine frame and is fastened to it by the bolts holding the crankcase up to the body of the engine. The front upper support is formed by a portion of the bracket that is clamped between the cylinder-head casting and the nozzle through which the water circulating around the engine cylinders passes to the radiator. The third point of support is effected by clamping a portion of the bracket between the main cylinder casting and the nozzle through which the cooling water passes from the radiator around the cylinders. The Genemotor itself, being circular, is carried on a malleable-iron support riveted to the bracket. The position of the outfit on this support is determined by adjusting screws, and it is rigidly clamped in position by means of a steel band provided with a tension screw. This method of mounting permits adjustment of the Genemotor both for alinement of the sprocket gears and tension of the driving chain. The installation is fully covered and protected by the engine hood when the latter is closed.

As a motor, the machine will develop a torque of about 45 pound-feet, and the torque developed at the engine shaft by means of the selected gear ratio has been found amply adequate to start a Ford car under very severe conditions of tight adjustment in the engine and cold weather. The storage battery is carried on the right-hand running board of the car, and is employed to store energy while the car is in motion for supplying the starting and lighting system when the car is at rest.

When the car has attained a speed of about 11 miles per hour, the Genemotor, acting as a generator, develops an electro-motive force sufficiently high to overcome the normal voltage of the battery and permit charging to take place. At this point, the reverse-current relay operates, closing the circuit between the generator and battery, and charging begins at a low rate, the current gradually increasing as the speed of the car increases to a maximum of slightly over 10 amperes.

A 26-tooth steel sprocket is mounted on the engine shaft at the point where the crank is ordinarily applied. A 13-tooth steel pinion, mounted on the motor shaft, drives this sprocket and thus the engine through a silent chain of special design. The Genemotor is running either idle, as a motor, or as a generator, at all times while the engine is in motion, and thus all clutches are eliminated. The fan is driven by a belt from the Genemotor-shaft pulley, mounted outside of the sprocket, to a split pulley provided for clamping onto the standard fan pulley.

The main switch and reverse-current relay are mounted in an inclosed metal case on top of the Genemotor and are readily accessible. The switch, which controls the motor, is closed through a cam actuated by a push rod extending through the dashboard of the car and terminating in a knob conveniently located near the steering-wheel column. The contacts are of the multiple-leaf pattern and the switch is provided with a mechanism that assures a quick break on opening. The reverse-current relay prevents current feeding back to the generator when the latter is operating at low speed or when the engine is not running.

The lighting switch, mounted on the dashboard at the right-hand side of the spark coil as one sits in the car, enables any group of lights or all of them to be thrown on or off. It is applicable either to the straight dash or the new cowl-hood dash on Ford cars. The wiring system is metallic throughout, no ground return being used. On the Sedan, Coupelet and 1915 models, the lighting switch is placed on the upper left-hand corner of the heelboard under the driver's seat.

Inasmuch as the Genemotor begins to charge the battery at the low car speed mentioned, the factor of economy is evident. When the engine stops, the reverse-current relay automatically opens the battery circuit. The salient feature of the Genemotor is, therefore, its simplicity. It requires no attention from the driver other than a push with the foot to start the car and a twist of the switch to turn on the lights.

The Genemotor with a complete equipment, exclusive of lamps, retails to the user at $75. The system can be readily installed by anyone with a fair degree of mechanical knowledge, or at any garage, at reasonable cost.

Arrangements have been made with A. J. Picard & Company, 1720 Broadway, New York City, for the exploitation and distribution of the equipment for use with outstanding Ford cars. This firm will supply Genemotors to retailers and owners of garages, who in turn will place them with owners and users of the Ford car.

New York Electric Vehicle Association Guarantees Used Cars.

Members of the New York Electric Vehicle Association have decided that one of the best advertisements of an electric automobile is its constant use and that slightly used cars on dead storage retard the sale of new ones. The association has in its garage, Central Park West and Sixty-second Street, a number of used electric pleasure vehicles which have been turned in in exchange for new cars by members of the Association and which are now to be sold at reasonable prices. All of these cars have been taken apart, and every detail of their construction examined by an expert engineer so that the association will give a guarantee with every car sold. The adoption of this extraordinary principle of the seller standing back of a used car speaks for itself of the confidence which the electric vehicle people have in their product and the certainty which they feel in the ability of the electric to last and to stand up. The association expects soon to acquire a number of used electric trucks and will adopt the same policy with these as with the pleasure vehicles.

Reasons for Users of Electric Trucks.

The following cogent reasons for purchasing electric trucks are given in an advertisement of the United Electric Light Company, Springfield, Mass., in a local newspaper:

"High-grade electric trucks are 100 per cent faster than horses.

"From 25 to 50 per cent cheaper to operate.

"Require 75 per cent less space than horses.

"Free from war prices, disease and broken limbs.

"Sanitary, odorless, practically noiseless.

"Require minimum reserve equipment to give uninterrupted service.

"Long lived; interchangeable parts; minimum repairs; ex-teamster drivers; easy on tires.

"Efficient because representing a high-grade engineering product, built especially for a given task."

Chicago Vehicle Men Discuss Electric Industrial Trucks.

At the meeting of the Chicago Section, Electric Vehicle Association of America, on April 27, two papers were presented on electric industrial trucks. W. F. Hebard described the vehicle made by the Buda Company, of Harvey, Ill., and T. H. Smith described the new electric tractor made by the Mercury Manufacturing Company, Chicago, Ill.